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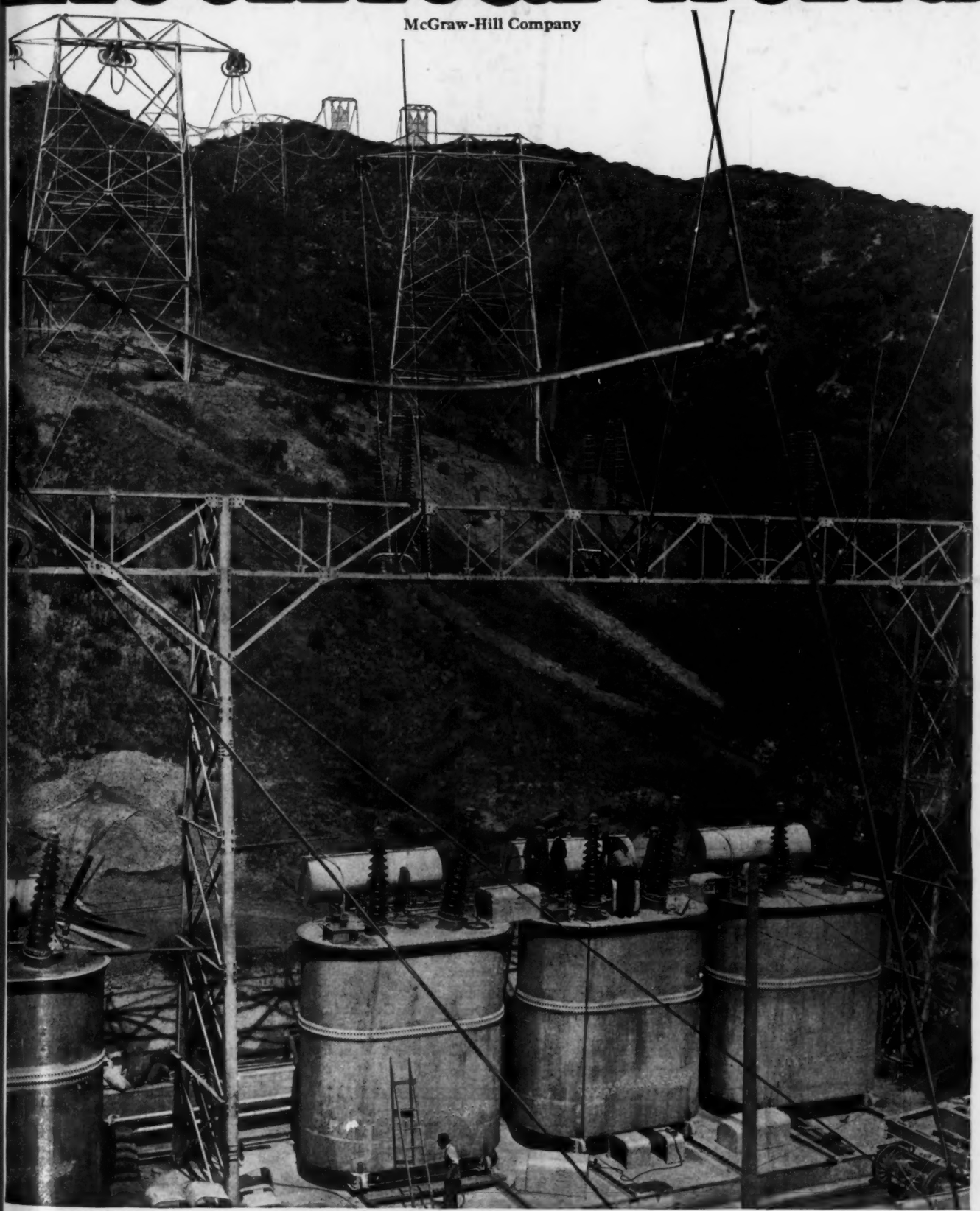

This issue contains: **Report of 39th Annual Convention of the A.I.E.E.**

also:
- Relations between the Architect and the Electrical Engineer
- Features of 1200-lb. Weymouth Station
- Semi-annual List of Electrical Associations and Societ

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Editorial Comment

Electrical World, July 7, 1923

Volume 82 Number 1

Another Electrical Pioneer and Executive Gone

JOHN A. BRITTON, the "dean" of the electrical industry on the Pacific Coast, has been summoned by his Creator. His death was unexpected, for he had just been made first vice-president of the National Electric Light Association as an earnest of the greater honor to follow in 1924. Those who heard him speak at that convention the last publicly spoken words of his life can attest to the uncommon grace of his bearing and of his utterance. Although old in years, still in heart and mind Mr. Britton was strong and resolute, and his speech before the Public Relations Section caused a very real, a very deep and a very spontaneous beating of hearts. His confidence in the West and its people was unbounded, and he had the happy faculty of inspiring others with his enthusiasm.

In his relations with employees and others Mr. Britton was considerate, even to a fault, and his attitude was more like that of a father than of a superior. His vision and ideals were high and poetic, and he perceived the hand of God in things in the earth. Few men have served the industry longer or more faithfully, and fewer have earned so great a reputation outside of it. But such nature, such admiration, such repute can be acquired only by the steady, silent, persuasive appeal of character, intellect and service extending over long years. To him the Pacific Gas & Electric Company stands as a monument.

An Outstanding Achievement in Station Design

TWO things stand out in the design of the new Weymouth station of the Edison Electric Illuminating Company of Boston, described in this issue. The first is a predicted thermal efficiency of more than 25 per cent, which means the production of a kilowatt-hour of electrical energy for 13,500 B.t.u., as compared with about 17,000 B.t.u., the best present practice. This is a tremendous improvement in steam-station economy and will have a very important bearing on the territorial limits of hydro-electric developments because of the economic considerations involved. In addition, this gain in economy will be reflected in national economic and social advantages difficult to measure or predict. Among these might be listed the conservation of national fuel resources, the more abundant and universal use of power because of decreased costs of production, and a quicker realization of a national power supply through increasing the economic limits of long-distance transmission.

The other outstanding element in the station design is the possibility of introducing into older and less economical stations the equipment necessary to bring their operating performance to a comparable stage of efficiency. The high-pressure boiler, turbine unit and reheating scheme can very readily be adapted to existing installations in most cases, and at a minimum of expense, as it is largely self-contained and can be placed on top, so to speak, of the existing plants.

The designers of the station are to be congratulated upon their initiative in devising an installation whose success will react so favorably on the whole industry and which yet, if it fails, will jeopardize in no way the efficient and reliable operation of the standardized portion of the plant. They have played safe and yet will be able to realize fully the possibilities of the high-pressure plant should experience prove its value.

Concerning the details of the design of the standardized portion of the station designers may differ, but a predicted performance of 15,000 B.t.u. per kilowatt-hour for this portion of the plant indicates its high caliber. Whether an air heater would result in higher economies than the use of economizers, whether pulverized-fuel equipment would have proved more successful than stokers, whether some other pressure than 375 lb. would have resulted in more efficient operation, are debatable questions, but a decision must be made one way or another and the proof of engineering judgment must usually be found in future experience. The excellence of the chosen design indicates that those responsible considered every possibility and alternative in the light of general and special considerations.

In the electrical layout of the station departures from existing practices are contemplated and at the same time the best existing practice has been incorporated. Segregation, an absolutely reliable excitation and auxiliary power supply, flexibility and operating contingencies of many kinds have been anticipated and provided for.

A study of the detail shows that the designers were daring and yet subordinated everything to their ideal of producing an economical plant which would provide reliable and continuous service to the people of the Boston metropolitan district. It is very encouraging to find this forward-looking type of engineering in the central-station industry. The actual performance of the station will be a matter of great interest.

To See Ourselves as Others See Us

PUBLIC relations have been the subject of many a discussion at conventions and other gatherings of electric utility men during the past few years, but little effort has been made to find out how the general public views the utilities. Public service commissioners have been invited, but they at best give principally a reflected opinion. We have been prone to discuss our problems among ourselves and then go home with a feeling of pride and satisfaction that all is well with our public relations. In contrast with the usual procedure, several outsiders were invited to attend the

convention of the Northwest Electric Light and Power Association held in Seattle last week and expressed themselves frankly on the problems of the electrical utilities as they are viewed by those not associated with the industry. Those who arranged the program are to be commended upon the character of the talks that were given. The men who made them did not mince words, and it is certain that their hearers were deeply impressed with the menace of public ownership which is threatening the utilities of this country. Public opinion is the most vital element of the central-station business, and more meetings of this character should be held at conventions.

Working Together for Improved Lighting

FROM the viewpoint of artificial lighting the dark ages have just passed and the suddenness of the appearance of the age of adequate artificial light, full as it is of tremendous possibilities, has found us unprepared and blinded. The modern electric filament lamp gives us a flexibility in size, control and color which, if understood and appreciated, provides potentialities in distribution and quality of light almost infinitely beyond those of the ages of candles and other flames. But the wonders of artificial light as an expressive medium as well as a utilitarian and an economic factor will not be adequately realized until lighting is freed from the narrow channels of pure engineering. Practically all fields of lighting demand for their exploitation the development of a composite individual in whom are peculiarly combined a knowledge of optics, engineering, economics and psychophysiology as well as an artistic feeling for light, shade and color.

Elsewhere in this issue M. M. Samuels touches upon some of the details involving the fixture designer, the engineer, the architect and the electrical contractor. In the design of a new building the architect usually has the responsibility of co-ordinating or harmonizing many elements, of which lighting is a very important one. He has a picture in his mind's eye of the completed interior. Usually he recognizes that he is no more a lighting expert than he is an expert heating engineer. He depends upon expert help and performs the function of harmonizer and often that of compromiser. He needs assistance in lighting matters and usually asks for it. But can he gain respect for the illuminating engineer, and can he attain any adequate knowledge of the wonders of artificial lighting, if artificial lighting is presented merely as a matter of outlets and fixtures, if it is considered from a viewpoint similar to that from which an element like heating is considered, if it is not shown that it must be planned for its total effect upon the appearance of an interior and with due consideration for the most important sense—vision?

In many new installations the electrical contractor merely carries out orders, but he can be helpful—indeed, very helpful—in rehabilitating the lighting of old buildings where a supervising architect is not available. The electrical contractor should develop a deeper and broader knowledge of the potentiality of artificial light.

The fixture designer, too, must do his part. He must break the ties of the age of candles, however charming the associations may be. He must design fixtures for modern lamps. He must introduce good lighting principles and design fixtures that have lighting aims instead of merely sockets for lamps attached to a beautiful form borrowed from ages past. Let him preserve all the artistic merit of those centuries when men were craftsmen and when, notwithstanding various crudities of life, mankind loved beauty. The brightness of modern electric lamps is many times greater than that of flames, and therefore modern lamps should not be too generally exposed. But this need not compel the adoption of the other extreme solely. Much of the illumination intensity on a given space may come from large areas, but usually some directness and a moderate degree of brilliancy is desired. We can have the charm of chandeliers and even of frosted lamps in large rooms if they are well out of the normal range of vision, but we can also have a large portion of the light come from concealed sources, reflected from ceilings or transmitted through dense glass or other media.

Nature's lighting in its most cheerful aspects includes the dominant directed light from the sun and the diffused light from the sky reflected from the surroundings. We can improve on natural lighting, but not by departing too much toward its unpleasant moods. Furthermore, the fixture designer should realize that different rooms and different activities require different methods of lighting. He should design fixtures which have lighting aims as well as artistic ends. He should design in terms of the present possibilities of light and of present requirements of lighting. Well may he keep an eye directed toward the past ages for artistic inspiration, but if he is to do his part in this age of adequate light, he must keep the other eye on the present.

If the fixture designer and the engineer will view modern lighting in its proper breadth and depth, surely architects will gladly accept the great aid of modern artificial light in making interiors safe, convenient, comfortable and even delightful places in which to live and work.

Simplification Arguments Causing Introspection

IS THE simplification excitement leading anywhere? This is a question not infrequently heard these days, and to satisfy doubters and inquirers it ought to be said that it is. In other words, there are real benefits to be realized by purchaser, by manufacturer and by distributor by a sincere simplification program put into practice.

Doubtless Washington, where the movement originally started, is in a peculiarly advantageous position to see the results of the campaign; and judging from reports from Washington there is substantial progress. The fact of the matter seems to be that the discussion has led large numbers of manufacturers to examine into their own practices and as a result has led many of them to abandon costly specialty work and devote themselves to mass or quantity production of the things they are most able to make. The result is lower manufacturing cost, reduced distribution expense, and finally a smaller price and better service to the ultimate purchaser.

If this program is a good one for the manufacturers in general, it is a good one for the electrical industry. Already there are signs that the electrical industry is actually taking part in the program. Every one interested should encourage so constructive and beneficial a plan.

High Continuous Voltage for Insulation Tests

THE development of the hot-cathode tube, through its rectifying properties, has made available at greatly reduced complication and expense continuous voltages of almost any desired value. This has already afforded opportunities for several important researches in the field of insulation and has drawn attention to some of the advantages of continuous over alternating voltage for commercial testing of insulation. The disadvantages of alternating voltage in high-capacity equipment, such as cables, and in the heating caused by dielectric losses are well known. The use of continuous voltage appears to avoid both these difficulties, and particularly to reduce the requisite volt-ampere rating of the testing equipment.

But the continuous voltage carries with it some troubles of its own. The most conspicuous of these is the phenomenon of dielectric absorption, or the slow soaking in of charge on the continued application of voltage. This is a most obscure phenomenon, and its magnitude varies over a wide range as affected by the composition of the dielectric and by temperature and moisture content. It is probably present in all types of insulation and is especially conspicuous in compound materials such as are used in commercial insulation. It is thus at present not possible either to predict or completely to control the degree of absorption present in manufactured insulation. Therefore all measurements of current resulting from the application of continuous voltage, as, for example, in an attempt to measure the insulation resistance, depend on the time of application and conditions of the material, which it is impossible to control or ascertain, and so are of little or no value. Information as to the value of continuous voltage for break-down tests is given in the paper presented by Hayden and Eddy before the annual convention of the A. I. E. E., in which they try to establish a fixed relation between the alternating-current and direct-current breakdown voltages. But here also this relation is found to vary with the material, with the rate of application of the voltage and with other influences. These variations are undoubtedly due in large measure to dielectric absorption and to rapid changes in conductivity and internal heating inherent in the steady application of continuous potential.

The far more promising field of usefulness for these high voltages at present is that of research into the nature of the dielectric phenomena which are so hard to pin down, such as absorption, phase angle, conductivity and dielectric breakdown. Investigation in all these fields may now be greatly extended by this means.

Transatlantic Radio Methods Gain in Accuracy

GRATIFYING progress in the physical control of overseas radio transmission was emphasized last week at the A. I. E. E. convention in papers by Alexanderson, Arnold and associated authors. It can now be stated on high authority that a pair of transatlantic radio-telegraph stations can be designed to operate within a very narrow range of wave bands at an efficiency satisfying extremely severe technical and commercial requirements. Guesswork has yielded to engineering development and the end is not yet. The technique of transoceanic radio telephony shows similar advances along the line of increased reliability and economy of operation.

Engineering strategy of a high order is at work in the research laboratories and field stations of the communication expert. The conquest of the ether by the aid of the ubiquitous vacuum tube, by the improved design of antennas, skillful elimination of carrier and side-band waves and the general betterment of auxiliary circuit apparatus is proceeding steadily. Associated new refinements in frequency measurement described by Horton and others point the way to a closer control of the ether traffic and increased service in a firmament fast being "grubstaked by electrical prospectors," to quote T. C. Martin. The outlook for further progress via the route of quantitative measurements of the strength of signal and noise waves is most alluring, as is that for a more scientific development of "loud-speaker" design, outlined at the Swampscott gathering by Nyman, Kennelly, Kellogg and other participants in the discussions.

THE ELECTRICAL WORLD is a consolidation of the ELECTRICAL WORLD, the *Electrical Engineer* and the *American Electrician*, which was effected on Jan. 1, 1906.

The ELECTRICAL WORLD traces its history to the year 1874, at which time *The Operator*, devoted entirely to telegraphy, began its career. In 1883 *The Operator*, which was a monthly, became *The Operator and Electrical World*, and on April 28 of that year the paper was divided and the ELECTRICAL WORLD began its separate career.

In 1888 *The Electrician*, which had been founded in 1882, was named the *Electrical Engineer*, which remained a monthly until 1890, when its first weekly issue appeared.

In 1894 the ELECTRICAL WORLD adopted its present quarto style. In 1896 the *Electric Railway Gazette* was absorbed, but this part of the paper was later combined with what is now the *Electric Railway Journal*. Early in 1899 the ELECTRICAL WORLD and the *Electrical Engineer*, which had then become the two leading weeklies in the electrical field, were purchased by James H. McGraw and consolidated under the name ELECTRICAL WORLD AND ENGINEER, and the McGraw Publishing Company was organized to assume ownership and management of this and other papers. The paper bore the name ELECTRICAL WORLD AND ENGINEER until 1906, when the *American Electrician*, a monthly founded in 1896 and owned by the McGraw Publishing Company, was absorbed. The paper has since been known as the ELECTRICAL WORLD.

Each of the editors of the various journals named has contributed to the traditions and standing of the publication in the profession and industry. C. O. Mailloux was in reality the first technical editor of the ELECTRICAL WORLD. Others who directed its editorial policy for a longer or shorter time were Franklin I. Pope, Dr. Louis Bell, Dr. Carl Hering, C. J. H. Woodbury, Joseph Wetzler, J. E. Woodbridge, Ralph W. Pope, N. S. Keith, H. W. Frye, G. H. Stockbridge, C. T. Rittenhouse, C. T. Child, C. P. Poole, T. C. Martin, W. D. Weaver, Frank F. Fowle, Dr. A. S. McAllister, F. M. Feiker and D. H. Braymer—the last five having served as editors of the paper with its present form and title.

The present staff of the ELECTRICAL WORLD consists of:

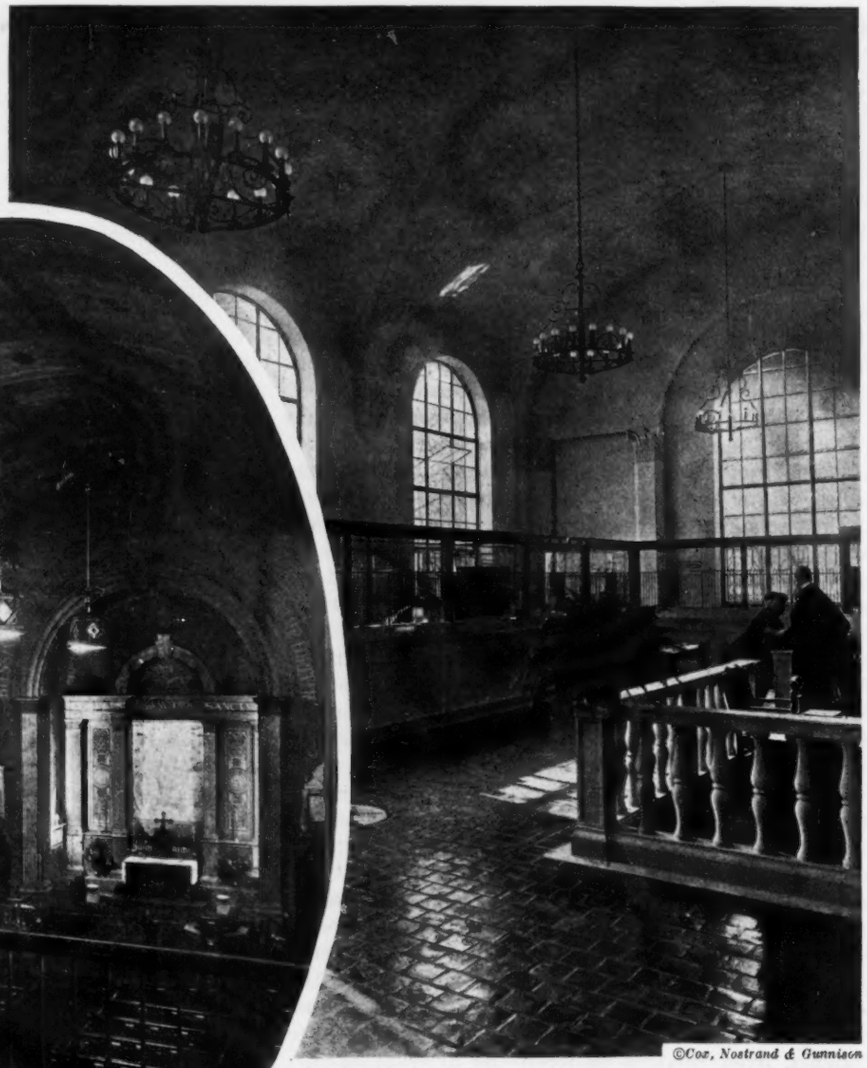
New York: W. H. Onken, Jr., and H. V. Bozell, co-editors; L. W. W. Morrow, associate editor; Allen M. Perry, engineering editor; Earl E. Whitehorne, commercial editor; R. M. Davis, statistical editor; T. P. Kindig, R. L. Shepherd, H. M. Cunnington, assistant editors.

Chicago: J. C. Martin, Western editor; H. C. Anderson, assistant editor.

San Francisco: W. C. Heston, Pacific Coast editor.

Boston: H. S. Knowlton, New England editor.

Joint Problem for Architect and Engineer



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CO-OPERATION is a game that architects and illuminating engineers are learning to play and one which has been found mutually beneficial in that it gives to their joint client — the builder—a structure which is both artistic and utilitarian. Where co-operation has been lacking it has too often happened that effective lighting has been sacrificed to harmonious artistic appearance or vice versa. Neither side is wholly at fault—each must respect the other's knowledge and shape its plan accordingly.

In the article by M. M. Samuels is told how one engineer is co-operating with architects. The author submits the accompanying pictures as examples: Top, right—Diffused lighting along bank tellers' windows. Bottom—Excellent interior illumination for a restaurant. In oval—Well-balanced church lighting, St. Mark's-in-the-Bouwerie, New York.

Architect and Electrical Engineer

Importance of Their Co-operation—Responsibility for Faults in Illumination Falls on the Engineer—His Occasional Shortcomings—Things that Must Be Considered in Making Plans

By M. M. SAMUELS
The J. G. White Engineering Corporation

THE serious fault of many lighting installations in otherwise well-designed buildings is that the fixtures are not designed to aid proper illumination and at the same time fit the architectural treatment of the rooms in which they are installed. Usually the question of illumination is neglected. To obtain the best results close co-operation between the electrical engineer and the architect is essential. The electrical engineer must assume the responsibility for sufficient illumination and the design of electrical features that will fit in with the architectural treatment and avoid inharmonious effects. To the architect belongs the responsibility for fitting the fixtures to their surroundings, at the same time allowing the electrical engineer opportunity to insure a safe installation.

There is a tendency to lay shortcomings in illumination at the door of the architect, the building owner or the electrical contractor. In some isolated cases here and there one or the other of these may actually be responsible, but the writer can testify to the fact that in all his dealings with architects he has found them ever ready to co-operate and gratefully to accept all reasonable suggestions. The specifications and figures used by architects are in all cases obtained by them either directly or indirectly from electrical engineers, and they use the best specifications available. The building owner has to depend on the architect, and the electrical contractor has to bid in accordance with specifications. Since most electrical contracts are given on a lump sum basis, the electrical contractor is naturally forced to furnish the cheapest material and labor which will pass inspection. It is, therefore, necessary for the electrical engineer to accept the responsibility for shortcomings in the art of illumination, to study them and to find means for their elimination. In accepting this responsibility the electrical engineer must also accept the responsibility of maintaining close co-operation with the architect. First of all, he must realize that it is not sufficient for him to know that the Underwriters allow only 12 outlets per branch circuit or how to figure watts per square foot or foot-candles. To be an illuminating engineer he must know something about light and shadows, about colors and their influence on the human eye and upon human moods and emotions, and he must at least know the difference between beauty and extreme ugliness.

The engineer must consult the users of electric light, office workers, factory workers, householders and others interested and must be trained to take criticisms and suggestions at their true value, as experience has shown that those who have been used to individual lights will at first be very much dissatisfied with general illumination, but will gradually accustom themselves to it and will then sing songs of praise in its favor. If judiciously applied, the criticisms of stenographers, draftsmen, bank cashiers and housewives can be of great value in discovering the actual shortcomings of the art. Furthermore, the engineer must at all times keep in touch with the fixture industry, as well as with the supply industry, to be able to apply all new improvements.

FAILURES OF THE ENGINEER

Often one sees a beautiful bronze fixture on a marble background, carefully designed by a skillful architect and installed at great expense, with a piece of unsightly rusty BX cable across the marble background carrying the circuit to the bronze fixture. Such negligence cannot be laid at the door of the architect, even though he could effectively protest against it. In expensive office buildings, even in some of the best banks, the lighting is sadly neglected. This is surely not due to any economical tendency on the part of the owners, because the expenditure on interior equipment often approaches waste. In fact, there are very few office buildings equipped with satisfactory lighting, and one very seldom encounters an office worker who is really satisfied with the illumination as it exists. He complains either of insufficient illumination, of improper distribution of illumination or of excessive glare. In apartment houses a similar condition prevails. It is seldom that the necessary outlets are found in the proper places when moving into a new apartment, even one of the most expensive type. This results in the necessity of swinging lampcords across the room, laying them on the floors or running them along the baseboard or picture molding. The cheapest kind of fixtures made of solder or tin are often found in the best apartments, though upon first glance they appear to be in accord with the architect's sketch. This, perhaps, is one of the reasons why the architect is sometimes blamed.

In some churches, well known for the beauty of their architecture and the wealth of the congregations, an almost intolerable condition of lighting is often encountered. Beautiful bronze chandeliers are provided by the architect, only to be equipped by the electrical contractor with glass globes of the most objectionable kind, neither utilitarian nor decorative, and allowing a painful glare without sufficient illumination for reading purposes, in spite of the fact that the wattage is much higher than would be required for reasonably good illumination.

SOME FAULTS OF LIGHTING INSTALLATIONS

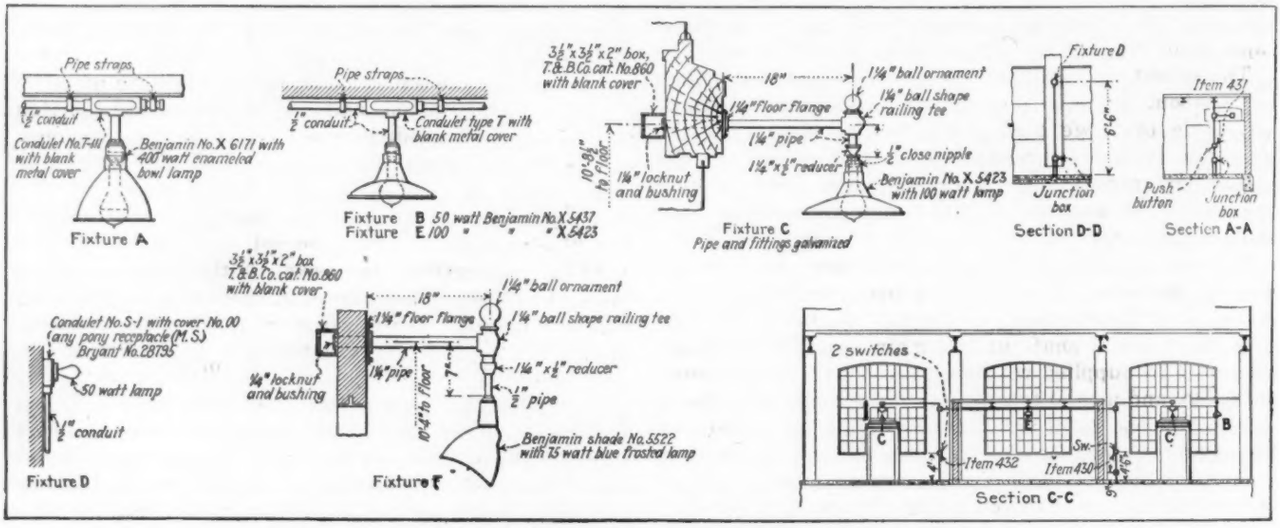
The following is a brief summary of some of the most important faults to be found in lighting installations, together with some suggestions for their elimination:

First to be considered is the method of preparing a lighting drawing. One good lighting drawing is more important than many pages of specifications. For elaborate work the lighting should not be indicated on the architect's plans, but should be taken care of by

separate drawings. The symbols used are of very little importance; any symbol will do as long as it is explained in a note on the drawing. The obsolete symbols, accepted years ago by the contractors' association, are still to be found even in the newest edition of electrical, mechanical and architectural handbooks, though they are hardly ever used by illuminating engineers. They only result in making the amateur believe that he is an illumination expert when he masters the key to these symbols. The best method is to indicate each outlet by a circle, giving an identification letter for the type of fixture inside the circle and the circuit number on the outside of the circle.

NATURE OF PLANS IMPORTANT

It is important to lay out the circuits properly and indicate the circuit number at each outlet, in order that the necessity of going back to the cabinet to try out a number of circuits before being able to identify a


Pipe straps
½" conduit
Conduit No. T-III with blank metal cover
Benjamin No. X. 6171 with 400 watt enameled bowl lamp
Fixture A
Pipe straps
½" conduit
Conduit type T with blank metal cover
Fixture B 50 watt Benjamin No. X. 5437
Fixture E 100 " " " X. 5423
3½" x 3½" x 2" box, T. & B. Co. cat. No. 860 with blank cover
18"
1¼" ball ornament
1¼" ball shape railing tee
1¼" Floor Flange
1¼" pipe
1¼" x ½" reducer
½" close nipple
Benjamin No. X. 5423 with 100 watt lamp
1⅛" locknut and bushing
10'-9" to floor
Fixture C
Pipe and fittings galvanized
Fixture D
Junction box
Section D-D
Item 431
Push button
Junction box
Section A-A
Conduit No. S-1 with cover No. 00 (any pony receptacle (M. S.) Bryant No. 28795)
50 watt lamp
½" conduit
Fixture D
3½" x 3½" x 2" box T. & B. Co. cat. No. 860 with blank cover
18"
1¼" ball ornament
1¼" Floor Flange
1¼" ball shape railing tee
1¼" x ½" reducer
1¼" pipe
1¼" locknut and bushing
10'-4" to floor
½" pipe
Benjamin shade No. 5522 with 75 watt blue frosted lamp
Fixture F
2 switches
Item 432
Item 430
Sw.
Section C-C

SEPARATE DRAWINGS FOR ILLUSTRATING PLANS PREVENT LEAVING THE EXECUTION OF WORK TO THE WHIMS OF THE CONTRACTOR

blown fuse may be avoided. All conduits should likewise be shown on the drawing, giving the conduit size and the circuits which it carries—i.e., "¾—15, 17," which would mean a ¾-in. conduit carrying circuits Nos. 15 and 17. Wherever conduit or "BX" is to be installed near elaborate fixtures the conduit entrances should be shown in detail, to prevent a contractor from installing it in the easiest and cheapest way. Cabinets should all be of the safety type, and standard specifications should be made available giving metal gage, thickness and other characteristics of slate, sizes of copper bars, trims, handles, locks and finish. It might be advisable to have separate sets of specifications available for first-class, second-class and third-class construction. Architects would gladly avail themselves of such specifications, and the better manufacturers would likewise welcome them because it would make it possible for them to quote on a known basis and eliminate the possibility of unscrupulous competition. Standard specifications should likewise be available for wire, tape and similar items.

The fixture problem is perhaps the most difficult to handle, because it is the least tangible. The modern idea of a fixture is that it shall be seen and not heard, and preferably not even seen, because a beautifully designed fixture sometimes gives the impression of being out of place when the lights are turned off. Here, too, it should be possible to have standard sets of specifications for offices, apartments, stores, factories, etc., each specification likewise subdivided into first-class, second-class and third-class construction. Such specifications should leave the architect a free hand for treatment and still be sufficiently clear to allow all bidders to quote on an equal basis.

The various specifications can cover the material of which the fixtures are made, the kind and quality of glassware, the types of sockets, the sizes of pipes and the material for the pipes. It should also be possible to develop a specification covering glare and distribution of illumination.

It must be admitted that it will be difficult and take a great deal of time to establish fixture standards ready for use. A beginning must be made, and even if a considerable length of time must elapse before an upper limit can be established, if it ever is, it is more important and within the range of possibility to establish a lower limit for the quality of fixtures. This should be a minimum line of demarcation that no architect would be willing to cross.

The location of main outlets must be determined by the types of fixtures used. It must be borne in mind that the incandescent lamp is steadily being improved in efficiency and quality, and a good lighting installation must make it possible for fixture improvements to follow upon radical improvements in lamp units. For auxiliary outlets, such as fan outlets, base receptacles, etc., there should likewise be a standard specification, subdivided into first-class, second-class and third-class construction, particularly for office buildings and apartments, and specifying for each case types and number of outlets.

Dr. Hutchinson's Chart

In "Directions for Use of Chart Enabling Calculation of Line Regulation," by Cary T. Hutchinson, printed on page 1467 of the ELECTRICAL WORLD for June 23, the equation near the bottom of the middle column should read:

$$\mu^2 = [1 + (x/r)^2]\rho^2$$

Under "Data: 7" the following equation should read $L = 66$.

Features of 1,200-Lb. Weymouth Station*

Boston Edison's New Plant Will Include Ultra High-Pressure Equipment—Normal Pressure Equipment Dominates Initial Installation—Design Combines Economy and Flexibility of Operation

By I. E. MOULTROP† and JOSEPH POPE‡

EXTRAORDINARY advances in the application of higher steam pressures combined with provision for flexibility and economy in operation throughout the plant characterize the design of the new Weymouth station of the Edison Electric Illuminating Company of Boston, now under construction to meet increasing demands for service which can no longer be adequately handled by existing generating facilities. The station is expected to have an ultimate capacity of 300,000 kw.

The selected site on the Fore River in Weymouth contains about 63 acres. It is on deep water, readily accessible by large oceangoing coal carriers, and has all other advantages necessary to give entire freedom in the design of a large modern station. The turbine room is to be adjacent to the waterfront so that the condensing-water tunnels will be direct and short.

The initial main generating equipment will consist of two turbines, each driving a main 30,000-kw. generator, and a 2,000-kw. auxiliary generator directly connected to the shaft of the main generator. These units will be supplied with steam at a nominal pressure of 375 lb. and a total temperature of 700 deg. F. There will also be one 2,500-kw. high-pressure turbo-generator taking steam up to 1,200 lb. pressure and exhausting into the 375-lb. system. All station auxiliaries are to be driven by alternating-current motors.

The boiler installation will include three boilers each containing 19,743 sq.ft. of heating surface, with additional superheater and economizer surface designed for 375 lb. working pressure. There will also be one boiler, of approximately the same heating surface, which will be designed to operate at a maximum of 1,200 lb. It will likewise be provided with a superheater, an economizer and a steam reheater to restore the temperature of the exhaust steam from the high-pressure turbine to 700 deg. before it passes into the 375-lb. system. All boilers will be fired with underfeed stokers.

The coal-handling equipment will consist of two electric unloading towers, a traveling bridge spanning the storage pile and a system of belt conveyors for transporting the coal to or from the main storage or directly from the unloading towers to the station bunkers. A Bradford breaker will be used for crushing the coal on its way to the station.

Energy will be generated at 14,000 volts, three-phase, 60 cycles. It will be distributed from the station through underground circuits partly at generator voltage and partly at 25,000 volts through an adjacent outdoor transformer substation. Future transmission by overhead lines at 115,000 volts will also be provided for.

The important bearing which the operating steam pressure and temperature have upon the possible maximum fuel economy of a station naturally called for an extended study of these features. It was apparent that this study, to be complete, would have to cover the following considerations:

1. The improvement in economy of heat utilization made theoretically possible by increased steam pressure.
2. The extent to which available equipment could be expected to take advantage of the theoretical possibilities.
3. The probable effect of increased pressure upon reliability of operation and its flexibility in meeting anticipated load conditions with high over-all economy.
4. Freedom in taking advantage of future changes in the art.
5. The economic balance of carrying charges and operating costs over a long period.

The development of one part of the study to determine the effect of the higher pressures upon improved economy is illustrated by the curves in Fig. 1.

Selection of Steam Conditions

If steam turbines could be constructed which would be equally efficient in transforming the available heat energy into useful work under all initial steam-pressure conditions, Curve 4 (Fig. 1) would indicate that the over-all thermal efficiency would increase with the pressure throughout the entire range considered. The most important factors which act to decrease the turbine efficiency at higher steam pressure are the increased gland and interstage leakage losses and, more particularly, the increased steam friction occasioned by the entrained water after the dew point has been reached. This lowered efficiency is particularly marked where the maximum permissible total temperature causes the higher pressures to be accompanied by diminished superheat, thus advancing the dew point to an earlier stage. The recognized method of meeting this difficulty and thus permitting the superior possibilities of higher steam pressures to be realized is to interrupt the expansion of the steam at some intermediate pressure and restore its temperature by reheating before the expansion is continued. This may be accomplished either by employing two independent turbines, one exhausting to the other through the reheater, or by returning the reheated steam to the lower stages of the same machine from which it was extracted. The design of the Weymouth station makes provision for employing the first of these two methods, using a maximum pressure of 1,200 lb.

In order that the reheater may be required to add superheat only to the steam, it is necessary that the exhaust from the high-pressure turbine be dry. The amount of energy that may be extracted from a given weight of steam between an initial condition of about 1,000 lb. at 700 deg. and the dry saturated condition is only a fraction of that which can be utilized by its

*From a paper presented at the convention of the A. I. E. E., Swampscott, Mass., June 25-29.

†Assistant superintendent of construction Edison Electric Illuminating Company of Boston.

‡Consulting engineer, Stone & Webster, Inc., Boston.

further expansion to vacuum after reheating. This condition permits the use of large standard-design turbine units for the second expansion stage of the cycle. Thermodynamically it makes little difference in the cycle efficiency at what pressure the steam is reheated, or, indeed, if it is reheated at all. In practical operation there is a certain pressure at reheat which gives the best combined efficiency of the two turbines working in series, but the efficiency at this pressure does not appear to be a great deal higher than at other pressures rather widely different from it.

Of greater importance are the mechanical problems connected with rehandling the steam, and the higher the pressure, within limits, the easier these become. For the particular situation under discussion it was desirable to have the lower-pressure portion of the plant able to function as a complete and highly economical station, so that the same considerations which control the selection of an initial pressure for the single-expansion cycle were allowed to govern the choice of a reheat pressure in this case. Although it appears from Curve 5 of Fig. 1 that about 600 lb. is the most efficient pressure for a single expansion unit, cost influences make a somewhat lower pressure more economical to use. For the Weymouth station the pressure selected is 375 lb.

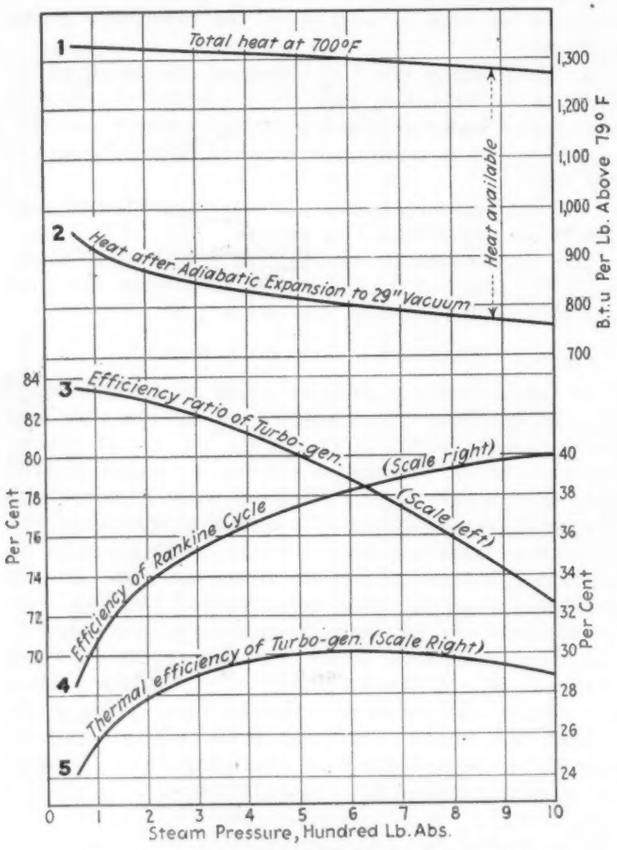


FIG. 1—EFFECT OF HIGHER PRESSURES UPON PLANT EFFICIENCY

(All of these curves have absolute steam pressure as their abscissas)

Curve 1—Total heat in 1 lb. of steam at a uniform temperature of 700 deg. F., above 79 deg. F., which is the temperature corresponding to 1-in. absolute pressure. It will be noted that the total heat shows a decrease with increasing pressure.

Curve 2—The heat remaining in the steam after perfect adiabatic expansion from the stated initial conditions to a pressure of 1 in. absolute. The vertical distance between this curve and curve No. 1 accordingly represents the B.t.u. per pound of steam theoretically available for doing work.

Curve 3—Best efficiency at present to be expected of turbo-generators in converting the available heat, as shown by Curve 3, into useful electrical energy. In determining this curve the unit is credited with all heat recovered in the condensate by bleeding at two stages.

Curve 4—Available heat as a percentage of the total initial heat shown by curve No. 1, representing the efficiency of the Rankine cycle at varying pressure. Its upward convex curvature indicates how the rate of increase in theoretical efficiency diminishes with increasing pressure.

Curve 5—The percentage of the total initial heat in the steam which would be actually converted into electrical energy or returned to the boiler in the condensate (product of Curves 3 and 4). It will be noted that this curve takes the shape of a dome, with its highest point corresponding to a steam pressure of about 600 lb. absolute.

HIGH-PRESSURE INSTALLATION

The high-pressure boilers will normally deliver steam at approximately 1,000 lb. pressure and 700 deg. total temperature, corresponding to about 153 deg. of superheat. The entire steam output of each boiler, which under the usual operating conditions will be about 110,000 lb. per hour, will pass through a simple three-stage turbo-generator, where it will be expanded down to a pressure of 375 lb. The steam will then be reheated to 700 deg. in a reheater installed in the same boiler setting and finally be discharged into the 350-lb. header serving the main turbines. It may be noted from the quantity of steam passing through each of the high-pressure turbines that three such boiler-turbine units will be required to supply one of the main 32,000-kw. turbines at the higher loads. Operating under the conditions outlined, each of the high-pressure turbines will generate about 2,000 kw. Thus a total of 6,000 kw. will be generated in reducing the pressure of the steam required by one of the main units.

The high-pressure boilers will have tubes 2 in. outside diameter and 15 ft. long. The tubes will be arranged in two banks with sufficient space between for the superheater and reheater. The drum will be a hollow-steel forging of 48 in. outside diameter with walls 4 in. thick. In order to maintain suitable drum strength, the tubes and nipples, which commonly enter the drum in lines parallel with its axis, are turned in pairs through an angle of 90 deg. so that the two enter the drum on a common circumference.

The generator of the pressure-reducing units rated at 3,000 kva. is to be of the induction type, if a suitable design can be worked out. This would avoid the necessity of separate excitation and careful synchronizing when being placed in service.

The ratio of high-pressure equipment and normal-pressure equipment to be installed in the future will depend upon the results obtained from this initial installation and upon the experiences of others who are working along similar lines or who are employing other methods for the utilization of high-pressure steam and the reheat cycle.

BOILER PLANT AND FEED-WATER HEATING

The normal-pressure boilers, which are to deliver steam at 375 lb. and a final temperature of 700 deg., will be of the cross-drum design, forty-eight tubes wide and seventeen tubes high, with the superheaters between the tube banks. The exit gases will be further cooled by straight steel-tube economizers which, with the induced-draft fans, will be placed above the boilers. The furnace arrangement provides for firing from the low end of the boilers. The stokers are to be of the underfeed type, with clinker grinders, there being sixteen retorts per boiler. The boilers will be set with the bottom of the uptake headers 25 ft. above the firing floor. They will be arranged in parallel rows with the uptake ends facing a common center aisle from which all firing operations will be controlled. The stokers,

which will thus be in the side aisles, will be supplied with coal from overhead longitudinal bunkers. This will assure well-lighted, clean and cool working quarters for boiler-room operators and locates the stokers where abundant side light and ventilation are obtainable.

Except for the necessary modification in details, the boiler designed for operation at 1,200 lb. pressure and previously described will be installed in accordance with the same general plan employed for the lower-pressure boilers. The stoker and furnace installation will be practically the same, and no attempt is to be made to isolate this installation.

Make-up water is to be provided by evaporators, and the entire supply will be deaërated.

Economizers with a heating surface equivalent to about 55 per cent of the boiler surface were chosen. This selection was preceded by a study of the following influential factors:

1. The temperature at which the feed water should leave the bleeder heaters and enter the economizers.

2. The most advantageous division of the total heating surface between the boiler and the economizer.

The capacity of the feed water to absorb heat is theoretically limited by the range between two fixed temperatures—that of the condensate and that of the saturated steam in the boiler. The practicable range of heating is, of course, somewhat narrower. The heat consumption of the main turbine, when credited with all heat returned to the system, is unquestionably the lowest when all of the heating is done by extracted

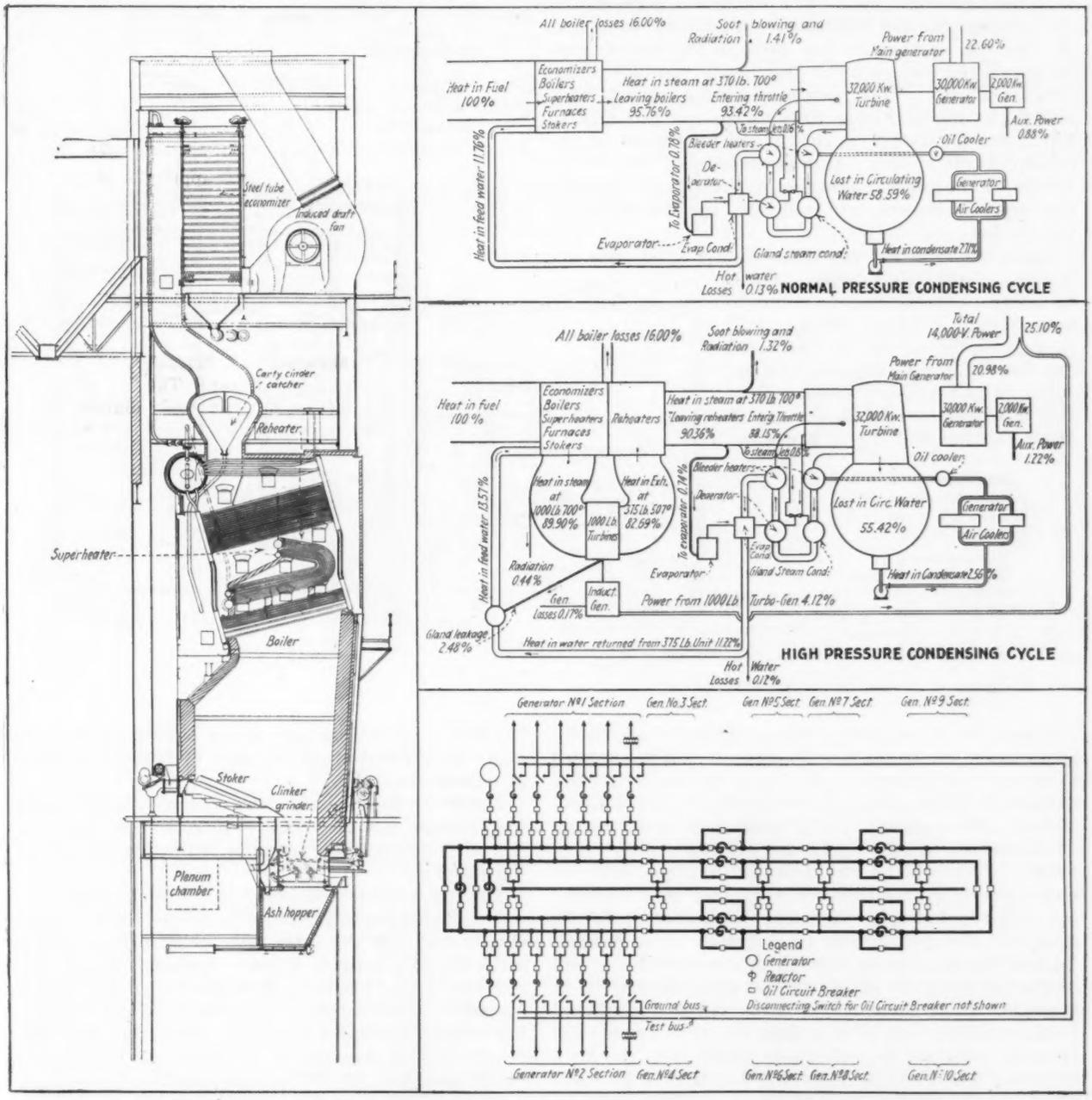


FIG. 2—CROSS-SECTION OF WEYMOUTH 1,200-LB. BOILER, GRAPHIC REPRESENTATION OF HEAT BALANCE, AND BUS, SWITCH AND REACTOR LAYOUT

The upper right-hand diagram shows an analysis of the performance which could theoretically be realized in the operation of the normal-pressure (375-lb.) portion of a station of the design described. The diagram below shows a similar analysis for such a station operating exclusively on the reheat cycle, with the entire steam supply generated at 1,000 lb. Both diagrams are based upon ideal operating conditions, i.e., a constant station load that would permit the main units to operate at best efficiency and at 100 per cent load factor. The efficiency of each piece of equipment is that guaranteed by the manufacturer.

steam. On the other hand, the efficiency of the boiler plant is highest when all of the heating is done in the economizer. The best over-all plant efficiency must therefore lie in some compromise between these opposing considerations. The calculations made for the Weymouth station indicated that the most advantageous temperature to change the method of heating was between 210 deg. and 220 deg. F. Practically considered, this is a most desirable temperature also, for it avoids the use of superheated steam in the extraction heaters, diminishes the possibility of external corrosion of economizers and permits adequate deaëration of the feed water.

Decision to fire the boilers with stokers was reached only after a very careful study of the relative merits of using pulverized coal. The conditions surrounding this problem for the Weymouth station were such that the probable savings in fuel through the use of powdered coal represented a relatively low percentage of the total fuel cost. This estimated saving was further reduced by the additional carrying charges to a margin which was too narrow to clearly call for the use of the powdered-coal system. It was accordingly decided to adhere to the present practice of the Edison company and employ stokers, at least for the initial boiler installation.

All of the normally operating station auxiliaries are to be electrically driven, using alternating-current motors throughout. Motors of 25 hp. and less will, in general, be served at 550 volts, and those of greater capacity at 2,300 volts. Any necessary speed regulation is to be obtained by the use of brush-shifting and slip-ring motors.

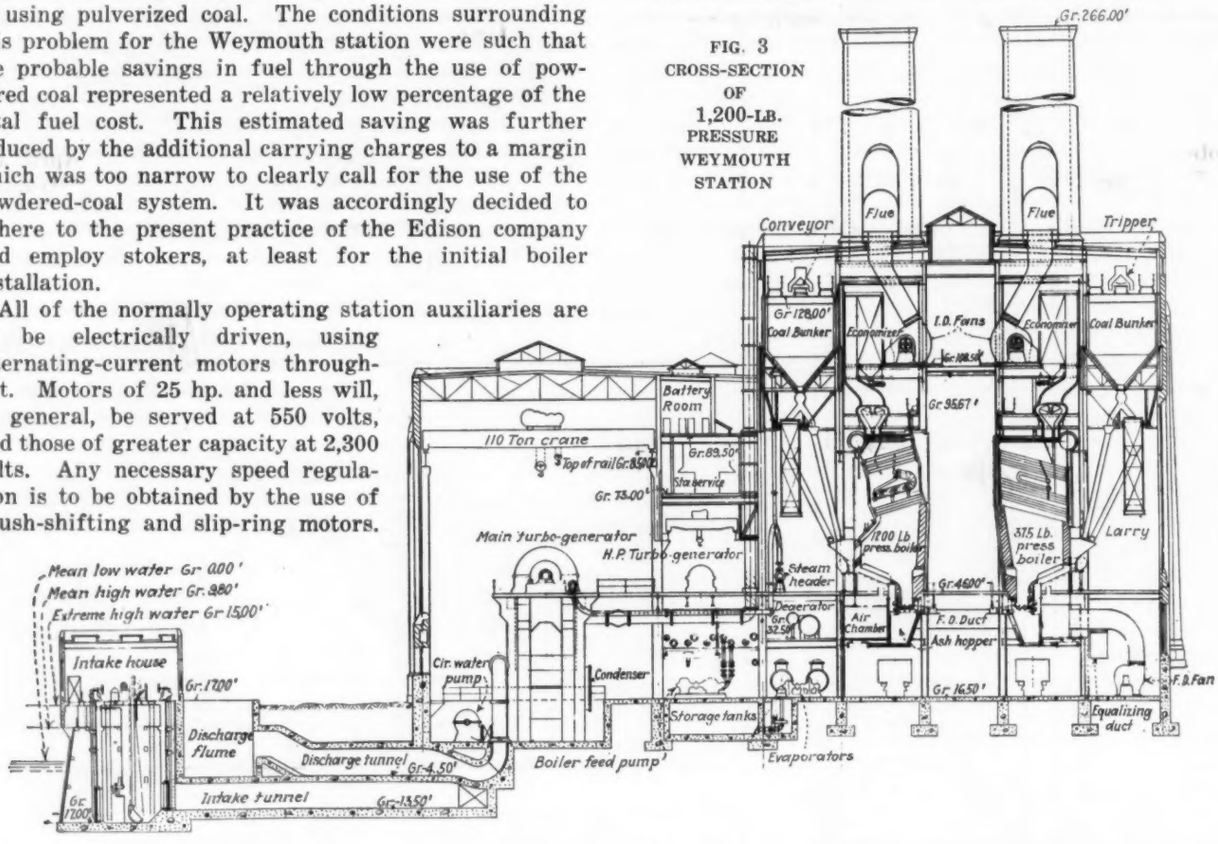


FIG. 3 CROSS-SECTION OF 1,200-LB. PRESSURE WEYMOUTH STATION

Power for all auxiliaries upon which the continuity of operation of the main units depends will be supplied from auxiliary generators driven by the main turbines through direct connection to the shafts of the main generators. These auxiliary alternators will have a rating of 2,500 kva. and will generate at 2,300 volts, three-phase. They will be mechanically in phase with the main generators, so that although they will normally operate independently, they may be connected to the main bus through suitable transformers when desired. In starting up a main unit all of the auxiliaries will be started from the main bus, but after the unit is in operation the important auxiliaries will be transferred to the auxiliary bus of that unit and thus be supplied from the auxiliary generator independently of the main circuits. The less important auxiliaries will be regularly operated from a 2,300-volt bus fed through transformers from the main bus. A separate steam-driven auxiliary turbo-generator will be provided to permit starting the station from cold in emergency.

Each generator will be excited by a 175-kw. motor-generator set, consisting of a 2,300-volt induction motor and a 250-volt direct-current generator. This set will be operated from the directly connected auxiliary generator. A spare motor-generator exciter and also a spare steam-driven exciter are to be installed for emergency excitation and for battery charging. A storage battery will float on the exciter bus. The 2,300-volt auxiliary generators will have directly connected exciters, but in an emergency may be excited from the 250-volt buses.

All incoming and outgoing circuits enter or leave through the cable room in the basement. In the layout of this room the following have been the guiding principles:

Proper segregation of the cables in the ducts.

Facility for taking any feeder circuit into any outgoing duct line without the need of further crossovers in outside manholes.

Means for testing any cable at any time at suitable high voltage and for complete protection of men working on cables through potential indicating and grounding devices.

Suitable space and handling facilities for cables.

The switch-house structure is subdivided by suitable longitudinal and cross-partition walls so that each bus section is in a room by itself. Conduit is run in floors and kept out of electrical structures wherever possible. Metallic reinforcement of concrete electrical structures has also been avoided as far as practicable, and where reinforcing is essential it is either discontinuous or solidly grounded, so that a high-resistance ground passing insufficient current to open the circuit will not cause heating of the reinforcement and disintegration of the concrete.

A double-ring bus is planned in conjunction with a single transfer bus. The two ring buses will be

sectionalized with current-limiting reactors between sections. Each section will be fed by two generators. It will be possible by use of the transfer bus to interconnect any two of the sections, thus permitting complete flexibility of operation. For the initial development only one bus section will be necessary, which will be operated simply as a double bus.

The connection of all generator and feeder circuits to the bus is to be through two oil circuit breakers in series so that there may be double assurance of ability to open the circuit under any emergency condition. This object may also be attained by the use of group buses if the capacity of the individual circuits is insufficient to warrant the expense of the extra breakers that would otherwise be required. The oil circuit breakers for use on feeders and for bus sectionalizing are guaranteed to rupture 34,500 amp. at 15,000 volts. Those on generators and on large-capacity transformer circuits which may connect with other power systems are guaranteed to rupture 58,000 amp. at this same potential.

The generators and their cable connections to the buses will be protected by balanced relays arranged to disconnect automatically any unit from the bus in the event of a ground or short circuit on the machine side of the circuit breaker. The generator leads are to be single-conductor cables carried on insulators from the machines to the switch house through closed corridors. No cables carrying a higher potential than 2,300 volts will be carried in ducts within the station.

On account of the relatively low capacity of the generators which are to be driven by the 1,200-lb. pressure turbines, the expense of providing the necessary switching equipment and building space for their direct connection to the main bus is not warranted. It is planned, therefore, to connect each group of three of these units to a separate bus through low-capacity oil circuit breakers. The group bus will in turn be connected to the main bus in about the same manner as a feeder.

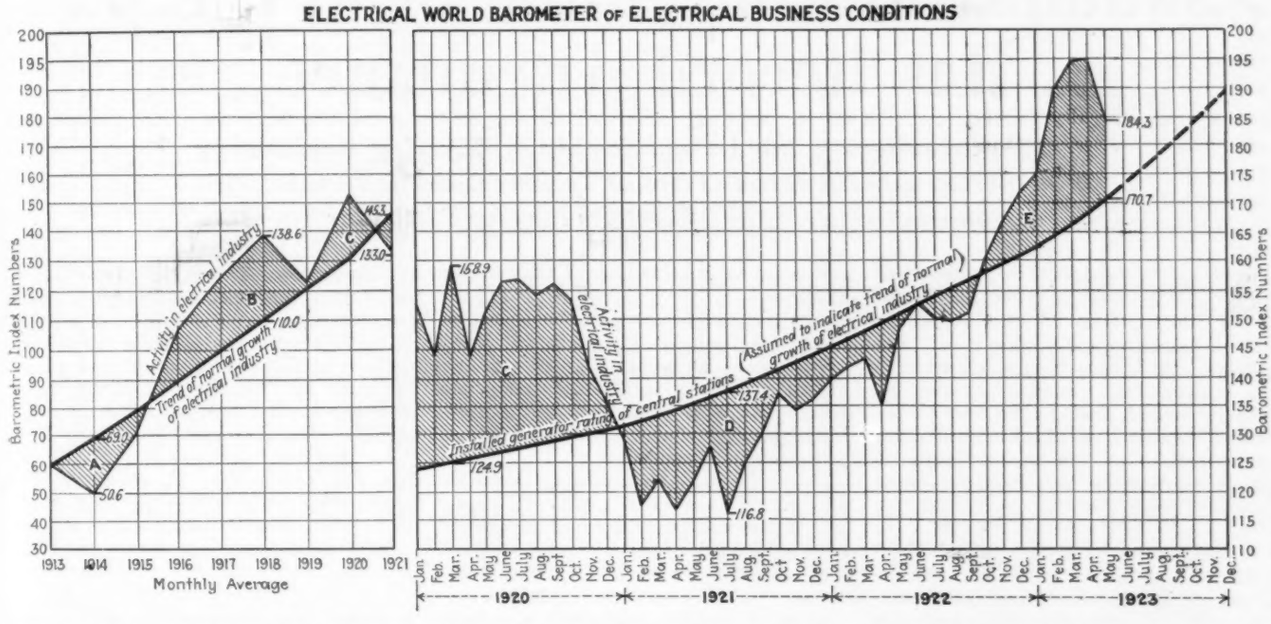
From the accompanying diagrams it will be observed that the normal-pressure, straight-condensing plant will transform 22.6 per cent of the heat in fuel into electrical energy, which is equivalent to 15,100 B.t.u. per kilowatt-hour net generated, or approximately 1.05 lb. coal of a heat value of 14,400 B.t.u. per pound, while the corresponding figures for the high-pressure reheat plant are 25.1 per cent, 13,600 B.t.u. per kilowatt-hour and approximately 0.945 lb. coal.

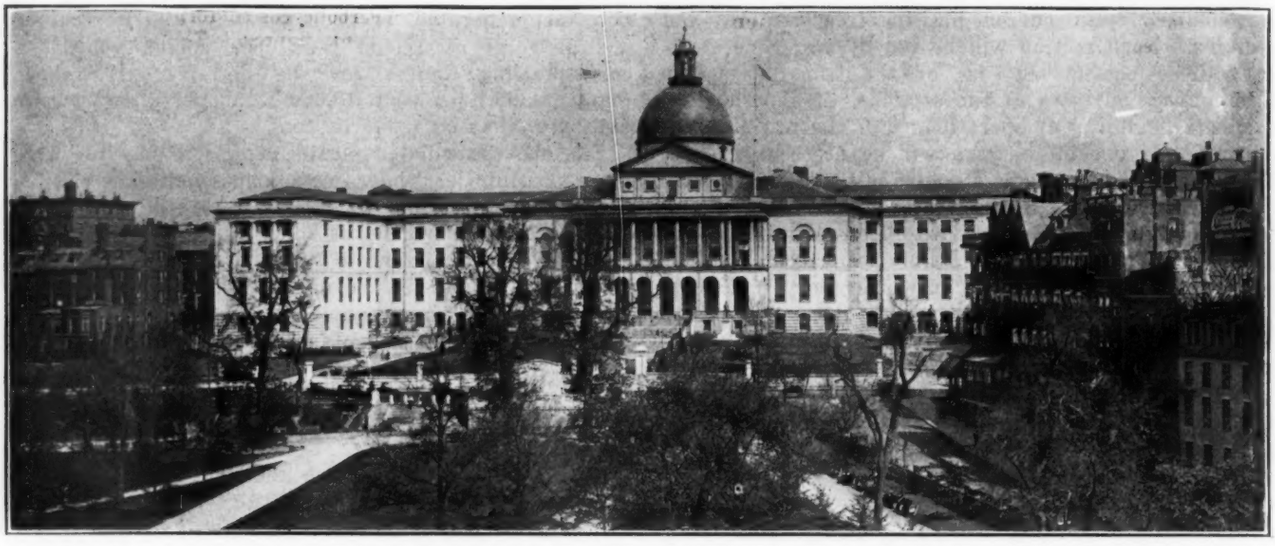
The above calculated results represent only the ultimate possibilities under ideal load conditions. It is, of course, impossible to predict what the results of actual operation will be, as this will be influenced considerably by the extent to which a constant base load can be allocated to the Weymouth station and the extent to which it is found advisable to employ the high-pressure equipment in making future extensions to the plant.

Decreased Activity During May

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activity within a few other primary industries decreased during April and May. The continued decline in volume of construction has begun to show a reaction—probably temporary—in the barometer of business conditions in the electrical industry. The *Engineering News-Record* construction volume index shows that between March and June there was a drop of almost 80 points in the index scale as compared with 1913 construction. Construction is now about 20 per cent under that of June, 1922. Contracts filed during the last two weeks in June, however, indicated that this decrease in volume of new construction had been halted, and that the volume of construction would be maintained about as of the middle of June.

The basic data upon which the "ELECTRICAL WORLD Barometer" is based indicate a decrease of 10.7 points on the barometer scale as compared with April activities. During this interval the industry has grown 2.7 points, leaving a net decrease in activity of 13.4 points on the barometer scale as compared with April. The electrical industry as a whole was operating in May at 13.6 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In April it was operating at 27.0 points or per cent above the point of normal demand.





Swampscott Convention of A. I. E. E. Has Record Attendance

Real Contributions to the Art and Science of Electrical Engineering Interspersed with Numerous Trips of Technical and Historic Interest —Phenomena Occurring in Dielectrics Receive Particular Attention

AN ATTENDANCE of more than 1,600 sets a new mark for conventions of the American Institute of Electrical Engineers. This was the registration at the thirty-ninth annual convention, which met last week at the New Ocean House, Swampscott, Mass., and it gives an indication of the value placed on the convention by the Institute members and their friends. As usual, the week was a full one and pleasure was combined with business. The afternoon trips to points of historic and engineering interest were highly successful, and the entertainment program left nothing to be desired.

That it was not all pleasure, however, is indicated by the fact that in the four mornings from Tuesday to Friday six technical sessions were held, besides one on Wednesday evening, while on Monday, before the formal opening, there was a discussion of sectional and regional problems, as reported in the news columns of the ELECTRICAL WORLD last week.

Most of the papers presented represented real contributions to the art and science of electrical engineering. Among the outstanding points in the technical sessions might be mentioned:

Description and discussion of the new Weymouth station of the Edison Electric Illuminating Company of Boston, with its high-pressure unit.

Discussion of the cooling of electric machines.

Steinmetz's interpretative discussion of his own scientific investigations of cable changes and discharges to show the practical application of the results obtained.

Account of laboratory facilities at hand, as disclosed by Peek, to study phenomena accompanying lightning discharge, these facilities having afforded a new tool for explaining hitherto mysterious phenomena in the extra-high voltage field.

Descriptions of Housekeeper's method of sealing base metals through glass, of a 12,000-volt direct-current generator and of a pellet-type oxide-film lightning arrester for moderate voltage circuits.

Reports on the increased accuracy and efficiency of transatlantic radio communication through the use of multiple-tuned antennas eliminated carrier and side-band waves and increased flexibility of circuit control; the improved methods of measuring signal and noise strength at receiving stations and progress in the measurement of frequency; the proposed test code for "loud speakers," and the value of artificial-line research to the electrical industry and to engineering education through the predetermination of transmission phenomena and the stimulation of students' interest.

A general account of the meetings, the papers presented and the discussion thereon is given in the following pages.

DIELECTRIC PHENOMENA

Soaking in of Charges Visualized by Dr. Steinmetz—Voltage Distribution Depends Upon Specific Capacities and Resistivities— Short Method of Calculating Cable Capacities

THE first session of the convention was opened by an address by President F. B. Jewett, whose line of thought was indicated in last week's issue. His theme was "Engineering Associations —Their Problems, Past, Present and Future." Following the delivery of this address three excellent papers more or less related to cables were submitted. One, by Dr. C. P. Steinmetz, gave a basis for visualizing what takes place in a dielectric when it is charged or discharged. The second, by J. L. R. Hayden and W. N. Eddy, brought out the wide range of ratios between direct and alternating voltage breakdown values. D. M. Simons presented a graphical method of calculating current-carrying capacity of cables.

Soaking in of Charges

Many mysterious phenomena occur in insulations which have prevented their utilization without allowing extremely large safety factors. Hence it is proper, declared Dr. Steinmetz, that considerable study be devoted to reaching a satisfactory explanation of these

phenomena if this important constituent of every electrical circuit is to be used most effectively. One of these phenomena is the soaking of charges into dielectrics.

Dr. Steinmetz declared that this is a true electric circuit transient, slower than electrical technicians are ordinarily accustomed to and caused by a gradual readjustment of charges within the dielectric due to combinations of capacitance and resistance which exist in all dielectrics. At the moment of voltage application the voltage distributes between the components of the dielectric in proportion to their specific capacities. Gradually, however, this voltage distribution changes to a distribution proportional to the resistivities of the component dielectrics and electrostatic charges built up at the boundaries between the component dielectrics. Owing to the high resistivity of most dielectrics, this readjustment is very slow and accounts for the long transients of minutes, hours and sometimes days.

As a result of this redistribution of stresses a dielectric may break down promptly or after a considerable application of voltage, depending on whether it is alternating or unidirectional and depending on how the distribution of stresses during this readjustment compares with the respective dielectric strengths of the components. Because of these reasons there can be no definite relation between breakdowns resulting from either alternating-current and direct-current.

Dielectric Strength Ratio

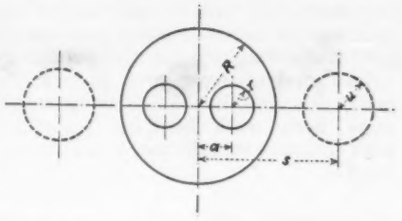
According to extensive tests reported by J. L. R. Hayden and W. N. Eddy, excess direct voltage is less likely to damage insulation permanently than alternating voltage. However, the ratios of the dielectric strengths measured with both voltages may extend over a considerable range. Sometimes this dielectric strength ratio may be very much greater than unity and sometimes less. Ratios less than unity were given by oils, petrolatum, powdered glass, etc., whereas ratios greater than unity were found with paper, cloth, solid glass, mica, etc. The ratio was found to vary considerably for laminated insulations and in general increase with decreasing temperature and thickness and increasing rapidity of voltage application.

Calculation of Cable Current-Carrying Capacities

A graphical method of calculating the safe current-carrying capacity of cable embodying the use of a "geometric factor" was explained by Donald M. Simons. With it results were determined for two, three and four-conductor cables and an empirical formula was developed. Compared with experimental results which have been obtained, the results with this method are very satisfactory, the author contended. Various applications of the formula to practical cases were illustrated.

Transients and Cable Capacity

The difference in transients in gaseous, liquid and solid dielectrics, the effect of previously charging a dielectric on its dielectric strength ratio and the possibility of calculating cable capacity by simple mathematics constituted the chief subjects of discussion following the presentation of papers by Messrs. Steinmetz, Hayden, Eddy and Simons. Dr. Slepian questioned whether the phenomena of soaking in of charges could be explained as Dr. Steinmetz did by attributing it to non-homogeneity,



taking as an illustration a vacuum dielectric. With this, he pointed out, space charges are developed which make the dielectric gradient non-uniform. The transient which occurs with application of voltage is more rapid than in a solid dielectric because of the freedom of movement of the electrons.

Mr. Simon referred to some experiments in which it was found that charging a dielectric in different directions prior to the measurement of the dielectric strength ratio has considerable effect on the results which are obtained. Using a steep wave front and previously charging one dielectric, the alternating voltage breakdown strength was more than cut in two, he explained.

H. B. Dwight presented an accurate mathematical method of calculating capacities of cables using the direct process of calculating capacitance and "geometric factors" of multi-conductor cables. The results, he declared, have agreed with those obtained by standard hyperbolic cosine formulas to six significant figures. The terms involve only the dimensions of the cables and can be calculated with a slide rule. The only disadvantage is that the formula contains a large number of terms.

CAPACITANCE OF TWO-CONDUCTOR CABLE

$$= \frac{1}{2\log_h F_c}$$

$$2\log_h F_c = \log_h \frac{(s-a-u)(s-a-r)(s+a-u)(s+a+r)}{r\,u\,(2a+r)(2s-u)}$$

$$+\sum_{n=1}^{n=\infty}\frac{L_n}{n}\left[1-\left(\frac{r}{s-a-u}\right)^n-\left(\frac{-r}{s+a-u}\right)^n+\left(\frac{-r}{2a+r}\right)^n\right]$$

$$-\sum_{n=1}^{n=\infty}\frac{M_n}{n}\left[1-\left(\frac{u}{s-a-r}\right)^n-\left(\frac{u}{s+a+r}\right)^n+\left(\frac{u}{2s-u}\right)^n\right]$$

$$u=\frac{R^2 r}{a^2-r^2} \qquad s=\frac{R^2 a}{a^2-r^2}$$

$$A_n=\left(\frac{r}{s-a}\right)^n-\left(\frac{-r}{2a}\right)^n+\left(\frac{-r}{s+a}\right)^n$$

$$F_n=-\left(\frac{u}{s-a}\right)^n+\left(\frac{u}{2s}\right)^n-\left(\frac{u}{s+a}\right)^n$$

$$B_n=-\left(\frac{r}{s-a}\right)^n\sum_{k=1}^{k=\infty}\frac{\lfloor n+k-1}{\lfloor n-1\rfloor k}\left(\frac{u}{s-a}\right)^k F_k$$

$$-\left(\frac{-r}{2a}\right)^n\sum_{k=1}^{k=\infty}\frac{\lfloor n+k-1}{\lfloor n-1\rfloor k}\left(\frac{-r}{2a}\right)^k A_k$$

$$-\left(\frac{-r}{s+a}\right)^n\sum_{k=1}^{k=\infty}\frac{\lfloor n+k-1}{\lfloor n-1\rfloor k}\left(\frac{u}{s+a}\right)^k F_k$$

$$G_n=-\left(\frac{u}{s-a}\right)^n\sum_{k=1}^{k=\infty}\frac{\lfloor n+k-1}{\lfloor n-1\rfloor k}\left(\frac{r}{s-a}\right)^k A_k$$

$$-\left(\frac{u}{2s}\right)^n\sum_{k=1}^{k=\infty}\frac{\lfloor n+k-1}{\lfloor n-1\rfloor k}\left(\frac{u}{2s}\right)^k F_k$$

$$-\left(\frac{u}{s+a}\right)^n\sum_{k=1}^{k=\infty}\frac{\lfloor n+k-1}{\lfloor n-1\rfloor k}\left(\frac{-r}{s+a}\right)^k A_k$$

For C_n and H_n use the same formulas as for B_n and G_n except change A to B and F to G. For D_n and I_n change B to C and G to H, etc.

$$L_n = A_n + B_n + C_n + \cdots$$

$$M_n = F_n + G_n + H_n + \cdots$$

WEYMOUTH STATION AND GENERATOR COOLING

Air Preheaters Versus Economizers—Desirable Size of Tubes—Importance of Reliability—Possibility of Incorporating Weymouth Design in Old Stations

IN THE Wednesday morning session, presided over by R. F. Schuchardt, the new Weymouth station of the Boston Edison Company was the topic of major interest. In addition, two notable papers on generator cooling were presented. In presenting the paper on the Weymouth station (see page 9 of this issue) I. E. Moultrop stated that a great opportunity now existed to utilize new principles and equipment in power-station design, and that it is becoming increasingly important to increase the efficiency of energy production in fuel-burning plants.

The two things that stand out in the design of the Weymouth station, I. E. Moultrop said, are the use of higher steam pressures and the decision not to use pulverized fuel in spite of its recent widespread adoption. A study of the stoker-fired plant in comparison with the pulverized-fuel plant showed no advantages in the latter. It had, instead, some disadvantages because of the newness of the type.

The use of high steam pressures was based on careful study to the effect that 375 lb. and 725 deg. temperature were the upper limits in pressure and temperature for use with standardized equipment and for economical operation. A study of various reheating schemes showed a promise of highest

efficiency for the installation of a 1,000-lb. boiler rather than a 550-lb. boiler, and in addition a unit cost comparable to that of the standardized plant. Load conditions prohibited operation of the station as a base-load plant, and this had a decided bearing on the decision. If the new station succeeds in reaching 15,000 B.t.u. per kilowatt-hour, it will be very encouraging because it will permit steam stations in the Boston district to compete successfully with St. Lawrence hydro-electric power for many years to come.

S. Z. Ferranti of England, in a written discussion, considered the design correct in its essentials. He commented on the fact that an economizer was used instead of an air heater and suggested that a further gain in economy could have been secured if a flue-gas heater had been used to increase the temperature of the feed water. He also stated that his experience had proved that the reheating boiler should be located very near the turbine to avoid long pipe runs.

Dr. D. S. Jacobus, in a written discussion, stated that the use of high-pressure steam was not new but that installations of large size were not available. In his opinion it might be economical to use 600 lb. pressure and not 1,200 lb. pressure with reheating to secure better operating economy in large stations. He also favored the use of an air heater, and said that it might be advantageous to eliminate the economizer entirely. In discussing the boiler design he stated that a more efficient boiler might have been designed with the use of 1-in. tubes and with only the two lower layers exposed to the flame, but that careful consideration showed that better and more economical operating conditions could be obtained with the existing design, which uses 2-in. tubes and six rows exposed to the furnace. Trouble with maintenance of refractories, maintenance costs and convenience in cleaning were governing considerations in favor of the present design.

Peter Junkersfeld stated that reliability in operation and minimum over-all productive costs were primary elements for designers to consider. He asserted that too much standardization in station design was fallacious as each plant had local conditions of a special character. The cost of fuel and the load factor are governing considerations in design, and the latter is a variable depending on local conditions. He desired to know why the specific pressures and temperatures were decided upon and the value of the efficiencies assumed in working out the predicted performance.

Professor Davis of Harvard said the paper proved conclusively the inadequacy of existing steam tables at the higher pressures, but that research work was now in progress and that data were available up through 550 lb. pressure.

L. L. Elden said that the station was to be used in connection with the company's complete scheme for supplying power to the Boston metropolitan district. It will be connected to a 110,000-volt ring high-tension line the other end of which will tap a future station to the north of the city. These stations with interconnections with the existing L Street station will serve the territory for many years. Provision is also made for tapping any hydro-electric source to the ring as developments occur in the territory exterior to the ring.

H. P. Liversidge emphasized the importance of reliable and economical stations for central-station service. He said that, although the new station involved radical departures in practice, yet it was safe, in that all contingencies have been anticipated in case the high-pressure installation proves unsuccessful.

The Weymouth type of installation recommended itself to G. L. Knight, Brooklyn Edison Company, because it could, if successful, be placed in some of the older existing stations to increase their operating efficiency and economy.

H. W. Eales stated that the Cahokia station, which used pulverized fuel, was designed for ready change to any other system of fuel burning should the art advance. He stated that discussion of pulverized-fuel installations was profitless until real data on the large stations were made available. A saturated core reactor connecting the auxiliary main bus was adopted for Cahokia and should be considered by other designers. He inquired if a double-current generator might not be used on the main-unit shaft to supply both excitation and auxiliary power.

Cooling Apparatus

A valuable experimental paper was presented by G. E. Luke on the cooling of generators. A complete abstract of this paper will appear in a later issue of the ELECTRICAL WORLD. The fundamental principle of the designer is to keep the machine operating continuously at the maximum permissible temperature and to have this temperature uniform throughout the machine.

C. W. Rice presented a research on "Free and Forced Convection in Liquids and Gases," in which he supported the Langmuir film theory, assembled extant information on the subject and extended the degree of theoretical knowledge concerning it.

V. M. Montsinger discussed the paper by C. W. Rice and stated that he had made experiments recently which supported conclusively the film theory of Dr. Langmuir. He said that the area of the heated surface and the temperature ranges used were very important in dealing with convection.

C. J. Fechheimer emphasized the difficulty of the heating problem, but asserted that the progress made in attacking its elements augured well for its future solution.

LIGHTNING SPARKOVER LAWS UNIFORM

Discharges Follow Same Laws as at Lower Voltage—Some Low-Voltage Conductors Become Insulators at High Potential—Insulation Deterioration Caused by Ionization Losses

DIELECTRIC ionization in one phase or another constituted the main theme of the four papers presented at the sixth technical session Friday morning. The paper by F. W. Peek, Jr., drew forth particularly thorough discussion. President-elect H. J. Ryan commended all the authors most highly for what he called the explicit way in which each stated the conditions under which observations were made. This, he declared, is particularly important because the breakdown of dielectrics involves a very complicated combination of several factors. Work of the sort represented by these papers, he said, will help explain some of the rather mysterious results now obtained in practice.

Peculiar Phenomena with Very High Lightning Voltages

Some remarkable phenomena take place when lightning voltages with a very steep wave front of the order of millions of volts per second are allowed to discharge, declared F. W. Peek, Jr., who has been studying these phenomena in the Pittsfield laboratory with a 2,000,000-volt lightning generator. For instance, much higher lightning voltages are usually required to jump a given distance than voltages at normal operating frequency; conductors at normal-frequency voltages are often good insulators for lightning voltages; water may be punctured like oil; the wet and dry sparkover voltages of insulators are equal; the lightning discharge has a decidedly explosive effect, etc.

The lightning sparkover of various gaps follows the same laws at these extremely high voltages as at the lower voltages. It usually takes a higher lightning voltage to "jump" a given gap than a low-frequency voltage.

The lightning sparkover of insulators is not greatly affected by rain or weather conditions. On a shielded string of insulators the spark may be made to clear in both fair and rainy weather. The lightning sparkover voltage is not reduced by the shield.

Certain materials that are conductors of moderate resistance at normal-

frequency voltages may be good insulators for lightning voltages. Tests in this direction indicate how useless a high-resistance lightning arrester is.

In measuring lightning voltages resistance must not be used in series with the sphere gap. Resistances so placed give the sphere gap all of the time-lag characteristics of the needle gap, and the sparkover voltage varies with the wave front.

An investigation of the change in characteristics of lightning waves as they travel along a transmission line shows a decrease in voltage and flattening of the wave front due to corona and other losses. The waves tend to double up or increase on striking an open line or an inductance. Under certain conditions the voltage on the far side of an inductance may be increased to three or four times the voltage that reaches the inductance. In general, inductance to be safe should be shunted by resistance.

Unusual interest was shown in the phenomena accompanying discharge of lightning voltages by the quite general participation in the discussion of Mr. Peek's paper. Dr. F. B. Jewett cited an interesting instance in which the conductor in a rubber-covered wire completely disappeared after a lightning stroke without damaging the rubber insulation to an appreciable extent.

H. Goodwin, Jr., R. H. Marvin and D. D. Clarke pointed out that Peek's investigation seemed to indicate that the resistance of wooden cross-arms may be of considerable insulating value against lightning discharges.

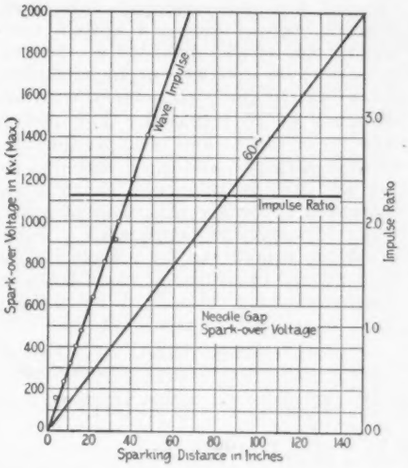
The time lag of sphere gaps is largely dependent on the time required to charge the spheres, declared J. F. Peters. He also pointed out that high-resistance arresters are ineffective, not because of a larger impulse ratio, but because of their inability to draw off large currents. Resistance, while detrimental in some respects in connection with arresters, may be beneficial in series with gaps to prevent their overshooting, he contended. The reflection characteristic of reactors is very valuable in connection with lightning arresters.

Dr. J. Slepian questioned whether the sphere gap can be considered as having no time lag when waves reaching a maximum in 10^{-8} seconds are involved. According to tests which the speaker reported, there is a lag in sphere gaps under these conditions of about 10^{-6} second. When gaps are in series with reactance such as exists in the leads the voltage may rise to double normal value, owing to resonance, if some damping resistance is not inserted. When the rate of rise of voltage is very large in comparison with the natural period of oscillation of the gap, the voltage measured by the gap may be far from correct.

H. J. Ryan pointed out that as the gap increases the impulse ratio diminishes.

D. D. Clarke referred to Peek's investigation as a new tool by which more definite information can be obtained regarding what happens on a transmission during lightning storms. He supplemented other speakers in suggesting that the resistance of wood cross-arms (wet or dry) may extinguish power arcs that may follow flashovers caused by lightning.

When the time for a voltage surge to reach maximum value is four and one-half micro-seconds the error with sphere-gap measurement may be 5 per cent, G. E. Howes announced, whereas if the time is only three-quarters of a micro-second, the error may be 24 per cent.



COMPARISON OF LIGHTNING AND 60-CYCLE SPARKOVER DISTANCES

The possibility of studying means of protecting buildings against lightning through the medium of the lightning generator was suggested by H. S. Warren.

Attention was called by K. B. McEachron to the enormous pressures which are produced by electric sparks. He said that 600 atmospheres are produced by even small sparks.

In closing the discussion on his paper, Mr. Peek urged caution in the use of series resistance with lightning arresters. While he did not contend that sphere gaps have no time lag, he expressed the belief that they are sufficiently accurate for measurements. He offered the explanation that the high pressures exerted within wood when it is subjected to a high-voltage discharge may be due to distillation of the wood. Studies are being made of lightning protection for buildings, he announced.

Gaseous Ionization in Built-Up Insulation

Gaseous ionization losses in built-up insulation begin about 4,000 volts (corresponding to an average potential gradient of about 16,000 volts per centimeter), declared Prof. J. B. Whitehead in his paper. Above this value the losses increase more rapidly than as the square of the voltage. For the most tightly wrapped mica-folium bars the exponent may be as low as 2.15. For bars high in mica, dried and expanded under temperature, it reaches 4.4. The values for the whole series of bars in the undried state lie between 2.15 and 2.6, with an average value about 2.3. In well-wrapped mica-folium insulation from 10 per cent to 40 per cent of the total dielectric losses are due to internal ionization. Ionization losses, while not of sufficient amount to increase materially the temperature of the coil, do, however, cause progressive deterioration of the insulation. The total dielectric losses in mica-folium and paper insulation increase with decreasing mica content. Reducing the mica folium by 75 per cent and substituting shellacked paper approximately doubles the loss. Omission of the final 25 per cent of mica increases the original loss ten times.

The internal air spaces which permit ionization are increased to some extent by the bowing of the mica on bending, but more particularly by loose wrapping and expansion of the insulation under temperature. Bars wrapped under temperature and pressure show the lowest ionization loss, but the run of the bars in each group of three is not uniform, occasional samples showing high ionization loss.

Danger of failure of mica insulation from corona is very small, declared C. J. Fechheimer, up to 15,000 volts. Where ionization holds over from crest to crest the voltage per inch required to break down the air gap may be reduced greatly, H. J. Ryan asserted. It may be as low as 1 kv. per inch.

D. M. Simons spoke very highly of the reliability of the quadrant electrometer in measuring small losses, saying that he had used one ten years without accident.

In the past the thickness and character of built-up insulations has been determined largely by allowable temperature and dielectric strength, but the possible effect of ionization should make this more of a factor for consideration than it has been, R. B. Williamson said. Even where dielectric strength and temperature do not demand mica insulation it may be desirable to use it to prevent ionization, especially in the higher-voltage rotating equipment.

G. E. Howes emphasized the need of minimizing air gaps in built-up insulation, citing some data which he had obtained. For example, an air gap 0.026 cm. thick will break down at 50 kv. per centimeter, whereas one 0.004 cm. thick will require 120 kv. per centimeter.

Photographic Methods of Studying High-Voltage Discharges

Some of the results of two methods of drawing out the alternating-current corona discharge along a time axis were presented in a paper by Karl B. McEachron.

The first method consists in photo-

graphing with the usual camera the discharge from a needle point revolved by the alternator which is the source of supply for the high-voltage transformer. The needle is revolved inside a porcelain tube whose outside surface is made conducting and grounded. The second method makes use of a special camera using mirrors revolved synchronously by the alternator itself. This camera is equipped with a shutter so arranged that photographs of sparks may be taken using one sweep of one of the mirrors. When drawn out along the time axis certain characteristics of corona discharges may be seen, even when the discharge is extremely weak, for the exposure may be continued for any length of time with a reoccurring phenomenon. The most interesting observations made as a result of the tests were the peculiar shape of positive and negative corona discharge and electric sparks.

The Axially Controlled Magnetron

When straight filaments of large diameter are used in vacuum tubes it is found that the magnetic field of the heating current exercises a restraining effect on the escape of electrons, equivalent to the action of the grid in the pliotron or the impressed magnetic field in the magnetron, Dr. A. W. Hull declared, in a paper describing a new type of magnetron. This new valve principle may be utilized to control the output of the tube for practical purposes, such as changing high-voltage direct current into alternating current. It leads to a very simple and efficient type of tube. The type of magnetron is operable only with large diameter filaments, and hence is adapted only to high power applications. For these applications, however, it appears to be the simplest and most efficient tube that has yet been studied. A system containing six single-phase units (twelve tubes) would give an output of 60,000 kw. of fairly good wave form, with an efficiency of 96 per cent. The power capacity of these tubes is ample for conversion purposes, and their efficiency, so far as can be predicted at present, compared favorably with that of other types of conversion apparatus. Many problems remain to be solved before high-voltage operation of these tubes is practicable, but there is no known obstacle or limitation in sight.

ARTIFICIAL LINES HELP STUDY OF TRANSMISSION

Method of Incorporating Distributed Constants for Determination of Short-Circuit Conditions—Engineering Research in Colleges Should Develop Into Valuable Service in Future

GREETINGS and felicitations from the British, French and Italian electrical societies were extended to the Institute membership on Thursday morning. Elihu Thomson and A. E. Kennelly represented the British organization, M. Le Blanc the French and J. W. Lieb and G. Faccioli the Italian. President Jewett responded for the Institute and thanked the delegates and the societies for their good wishes for its success.

The program for the session consisted of seven papers on transmission and allied topics. F. S. Dellenbaugh, Jr., described the artificial transmission line built at the Massachusetts Institute of Technology and gave the design formulas upon which the line was based. A three-phase, 400-mile line and the equivalent of a 1,000-mile, 110,000-volt, single-phase line have been made available and practical data have been obtained from the structures.

The line is built up of unit coils of wire, tinfoil and condenser paper so as to give the effect of distributed constants as in the construction of the early Pupin line. The line has limitations in regard to skin effect, leakage and dielectric hysteresis, and it also is a periodic structure so that cut-off occurs at the higher frequencies. It was used by V. Bush to study transients and the results were embodied in the paper by Mr. Bush. Experimental transients obtained from the line and from actual installations checked the theoretical transient curves very closely, although the actual wave fronts were rounded slightly.

A modified type of combined T and Pi artificial lines was presented in a paper read by Dr. A. E. Kennelly for the authors, H. Nukiyama and K. Okabe. The paper dealt with steady-state conditions and gave the design calculations for determining the line. The line furnished an opportunity to secure greater flexibility over wide frequency ranges.

The solution of network alternating-current problems was the subject of a paper by O. R. Schurig which dealt with the possibilities and limitations of using miniature systems to obtain solutions of the problems encountered. The miniature system has an accuracy of the order of about 10 per cent in determining current divisions under normal and abnormal conditions, voltage and current phase relations at any point and the limits of stability in machine operation. The author advocated the use of the miniature system for large alternating-current networks involving problems whose mathemetical solution is particularly difficult. The structure and its design elements were detailed and examples of its applications cited.

A simplified method for solving short-circuit problems was the subject of a paper by R. E. Doherty. The author neglected resistance and capacity and developed a method for determining short-circuit current magnitudes based on the theorem that with zero R and C the magnetic leakages of a circuit were constant. Under this hypothesis the current only can change when abnormal conditions occur and its magnitude can be determined. The theorem was applied to several typical cases.

Proximity Effect and Floating Neutral

In furnaces, heaters and high-frequency induction applications occasions may arise where it is necessary to determine the proximity effect in wires and their tubes, and H. B. Dwight discussed the mathematics of the subject in his paper. The method of solution is based upon determining the current at any point and balancing it with the current effect of the return conductor. Applications of the formula were outlined and treated fully.

The floating neutral in an n-phase alternating-current star system was the subject of a paper by L. A. Doggett, and by a simple formula the author showed how the neutral could be determined for any unbalanced circuit.

In opening the discussion President Jewett called attention to the similarity in problems and methods of attaching them now existing in the communication and high-tension fields of electrical engineering. Aram Boyajian discussed the paper by Mr. Bush and stated that the discrepancy between the theoretical and actual wave fronts found in the paper could be explained by the fact that the theoretical curve was inexact in that several factors had been neglected in its determination. If skin effect, for example, had been incorporated in the formula, a rounded wave front would have resulted.

Lines having distributed loads or network connections were not susceptible to artificial-line solutions, J. F. Peters asserted. Any accurate solution of a transmission-line problem must also consider the inertia and reaction effects of rotating machinery connected to the circuit. He also said that surges were not accurately represented in artificial lines because the inductance was lumped and real distributed constants could not be devised.

It has been thought that the steeper the wave front the more disastrous the effect of a surge, but Dr. J. Slepian declared this held true only up to a definite value of wave-front magnitude as stated in the paper by Mr. Bush. He also said that wave-front steepness was a relative term and should contain an element of time. He preferred to refer to a time element based on the natural period of oscillation of the circuit or apparatus considered. He also thought that double voltage might not occur on short open-circuit lines because the reflection would be modified by other conditions. Moreover, on short circuit, although double voltage due to reflection would occur, the actual voltage to ground might be much less because of the polarity of the superimposed wave.

O. R. Schurig discussed the percentage errors occurring in instrumental measurement of transients and pointed out that for errors not exceeding 5 per cent about the same percentage of error is obtained with either series or shunt-connected instruments. In a written discussion of R. E. Doherty's paper, Prof. W. V. Lyon, Massachusetts Institute of Technology, pointed out that resistance plays a larger part in determining the first rush of current in short circuits than is generally realized.

Engineering Research Inspires Students

Prof. D. C. Jackson, Cambridge, showed how the development of artificial transmission lines at the laboratories of the Massachusetts Institute of Technology had stimulated the interest of students in this class of problems. He pointed out that engineering research by graduate students, instructing staffs and seniors has an influence upon undergraduates that will develop into valuable service in future years.

H. W. Buck said that the real test of engineering progress is whether simplification is attained and contended that modern network and transmission equipment costs are too high.

H. L. Melvin, Spokane, Wash., predicted that engineer-executive attitudes toward research will change as younger men trained in research enter the profession and advance into its front lines. Other speakers emphasized the value of miniature lines in cable transmission studies and urged use of alternating-current calculating tables in system studies.

Closing, Prof. Dellenbaugh touched upon the value of artificial lines in graduate instruction. The evils of such lines are less than those of a "lumpy" type of line in actual service, from the investigator's standpoint. At Cambridge a 1,000-mile artificial line, single-phase, built in 8-mile sections, occupies only the space of a 4-ft. cube and cost but 60 cents per mile. A 450-mile three-phase artificial line built in 20-mile sections occupies 25 per cent more space.

Mr. Schurig stated that at present measuring methods employing vacuum tubes are more suited to laboratory than to field conditions.

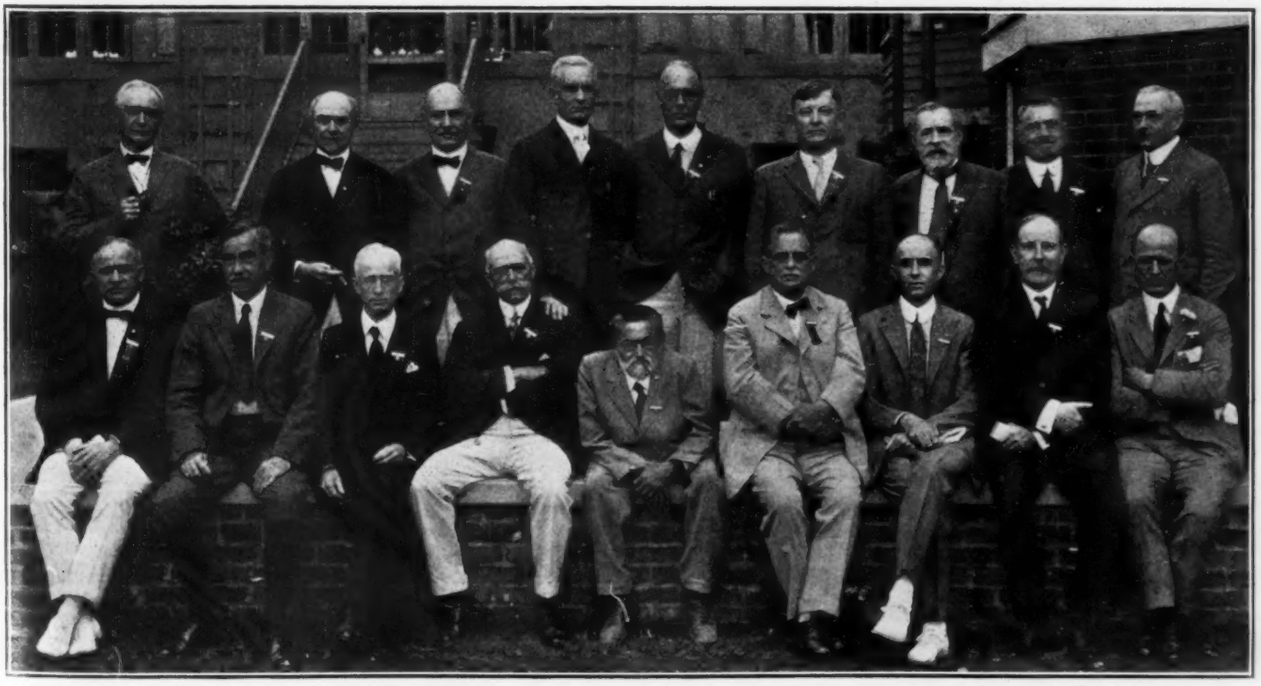
OXIDE-FILM ARRESTERS AND QUALITY OF LAMPS

Methods of Sealing Base Metals Into Glass, Standardization of Measurements, and High-Voltage Direct-Current Generators Were Also Given Consideration

A VARIETY of subjects occupied the attention of the convention at the fifth session Friday morning. Principal interest centered in the quality of incandescent lamps, the standardization of measuring instruments and the pellet type of oxide-film lightning arrester, though W. G. Housekeeper's description of methods of sealing base metals through glass excited much favorable comment.

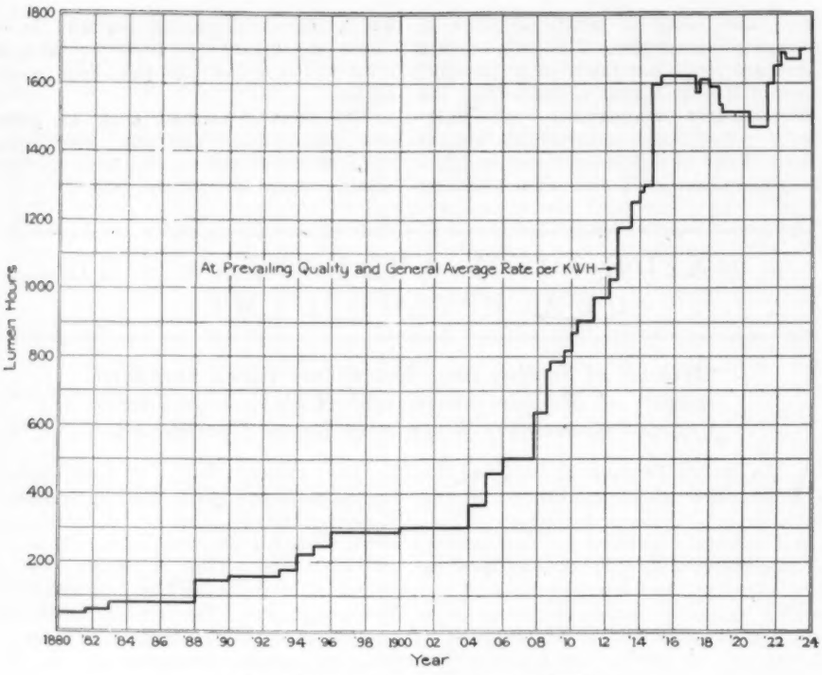
Quality of Incandescent Lamps

In a paper which gave a great deal of historical data John W. Howell and Henry Schroeder showed the development of the electric incandescent lamp from the standpoint of its quality and the amount of light or illumination which can be purchased now for one cent as compared with earlier days. For example, the 40-watt vacuum lamp is now more than eight times as efficient as the 40-watt lamp of 1907, when tungsten lamps were first introduced. Likewise, if the present 40-watt lamp were made for the same mean efficiency as the lamp of 1880, it should have a life of more than one hundred and fifty thousand years. The general reduction in cost of lighting consists, of course, of two factors—improvement in the lamps and reduction of rates for electrical energy. It is estimated that in 1880 about 50 lumen-hours of light were obtained for one cent, covering the cost of energy and lamp renewals —this from the 40-watt tungsten lamp. At the present average rate of 4½ cents per kilowatt-hour 1,700 lumen-hours can be had for one cent from the 40-watt size. If there had been no rate reduction, 432 lumen-hours would now be had because of lamp improvements; if there had been no lamp improvements, 190 lumen-hours would now be



PAST-PRESIDENTS IN EVIDENCE AT SWAMPSCOTT CONVENTION

Out of twenty-four living past-presidents, sixteen were in attendance at the convention. These sixteen, together with President Jewett and President-elect Ryan, made eighteen Institute presidents together, the largest number, it is said, that ever gathered at one convention. The photograph shows seventeen of the eighteen, together with Secretary Hutchinson. Top row, left to right, they are: Calvert Townley, E. W. Rice, D. C. Jackson, C. F. Scott, P. M. Lincoln, W. McClellan, Carl Hering, J. W. Lieb, and F. L. Hutchinson. Bottom row, left to right, they are: A. W. Berresford, R. D. Mershon, H. J. Ryan, T. Comerford Martin, Charles P. Steinmetz, Elihu Thomson, F. B. Jewett, A. E Kennelly, and C A. Adams. H. W. Buck was also present.



IMPROVEMENT IN LAMPS SINCE 1880

had because of rate reductions. If the basis of measurement of present-day values is shifted to the gas-filled lamp of the 1,000-watt size, 3,820 lumen-hours can be had for a cent on the 4½-cent rate. The use the public has made of these improvements is to use more light. If the same amount of light—for which about $500,000,000 was spent in 1922—were produced by the 1880 method rather than the present-day method, the cost would have been increased $3,500,000,000, requiring about fifty million extra tons of coal.

John W. Lieb, in discussing this paper, pointed out that the improvement mentioned was not alone a scientific development but also that it had been introduced commercially to widespread advantage, and yet all this had been done without any shock to the rising young industry due to abrupt loss of load as a result of great increases of efficiency. The industry had smoothed over these turbulent changes. He warned against a too narrow interpretation of the word "quality." It should not refer alone to efficiency and life, but should also include the elements of ruggedness, applicability to both alternating and direct current, uniformity of behavior, etc.

Clayton H. Sharp questioned the 500-hour testing basis used by the author and pointed out that, though this method is in vogue with the lamp manufacturers, it is not generally accepted by other testing agencies.

Sealing Base Metals in Glass

William G. Housekeeper in his paper described the process and development which has led to the ability to seal base metals through glass. The fundamental principle is to use thin strips of the base metal with edges tapered off to a fine-angle edge. This work has made possible dependable seals in the large-size lamps and other electrical apparatus where a conductor into a glass inclosure is necessary. Various illustrations were given of seals which had been made in this way.

Discussion by several indicated the great importance of the development, Prof. C. F. Scott pointed out that what Mr. Housekeeper really had done was to take the commonplace and by means of studies produce desired results—he had not sought the solution in new fields, but rather in well-known ones.

Answering a query as to whether metals other than copper could be sealed in, on account of the occluded gases, Mr. Housekeeper said that any metal, such as nickel, if heated in a vacuum at about 800 deg. C. for fifteen or twenty minutes, could be sealed in at any time within several weeks without the appearance of gas bubbles.

Instrument Standardization

H. B. Brooks, speaking for the subcommittee on instrument standardization, presented arguments for national standard specifications for instruments, from the standpoint of purchaser, manufacturer and every one concerned. The paper also reviewed the situation in other countries and presented a proposed set of specifications for discussion, modification and adoption.

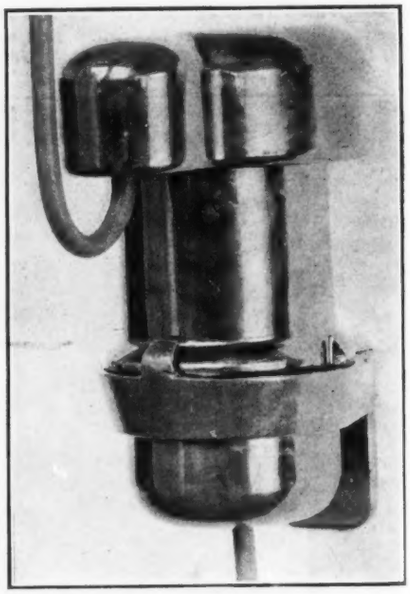
W. B. Kouwenhoven, A. E. Kennelly and C. N. Greene discussed the paper, calling attention only to minor points, except that Professor Kennelly pointed out that specifications made for American use should consider the requirements of international use and therefore use uniform terminology and units. The necessity of the work proposed by Mr. Brooks was unanimously approved by persons attending the session.

Pellet-Type Oxide-Film Arrester

N. A. Lougee described the new pellet type of oxide-film arrester. Fundamentally, an oxide film has been applied to a large number of pellets, or pill-like pieces, of lead peroxide and a large number of these pellets have been placed between two electrodes—the assembled unit forming a practicable, inexpensive arrester for use on low-voltage circuits (primarily 2,300 volts to 13,200 volts). The advantage of the unit lies in its application to general industrial and distribution transformers and apparatus. In action each pellet is a small individual oxide-film arrester, acting in series to allow surge current to discharge but not to allow any dynamic or normal frequency to flow. The oxide coating actually behaves more as a porous spacer than as a solid insulation.

The electrical characteristics of this pellet-type arrester are very similar to the "OF" type, according to oscillograms.

Dr. C. P. Steinmetz, in discussion, pointed out that this arrester fills a gap in the lightning-arrester line. He traced the development of the multigap arrester, the aluminum cell and the oxide film each to do its work, and then showed how the present pellet type comes in, largely on account of the economical element—the regular oxide film is too expensive for small distribution circuit equipment. E. R. Stauffacher asked if a number of the pellet-type

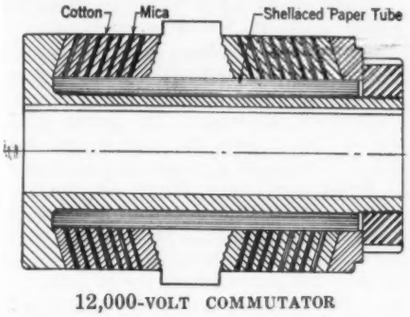


OXIDE FILM ARRESTER FOR 2,300-VOLT SERVICE

arresters could be used to replace an oxide film at substations and other rather larger installations, and Mr. Lougee indicated his belief that they could. A. L. Atherton said that both the large manufacturers were treating lightning arresters from the same standpoint, namely as necessary protection to their primary electrical equipment. The protective equipment is in the nature of necessary accessories.

A 12,000-Volt Direct-Current Generator

S. R. Bergman described the principles underlying the successful design and manufacture of a high-voltage direct-current generator. He attributed the success of the design to its being



12,000-VOLT COMMUTATOR

based on or built around commutation. A distributed field winding as well as a distributed armature winding made possible successful commutation, even though the voltage between bars is high. The principal mechanical problem was to build the commutator. A special construction, as shown in the accompanying illustration, made this possible. The principal use of such a machine is to provide the plate voltage of large vacuum tubes.

Duplication of Generating-Station Equipment

In the absence of William F. Sims, his paper on this subject was presented by title. In it he listed various apparatus which should be duplicated in order to insure continuity of service—such as buses, excitation supply, synchroscopes, some auxiliaries, etc. R. L. Young, in discussion, pointed out from the standpoint of the user the desirability and value of continuity of service. He stated that in some cities it was possible, on account of the high reliability of service, to depend on absolute continuity if supply were had from two power houses, but that in other places, where less attention was paid to this, such users as the telephone company had to install gas engines or other emergency auxiliary supply.

TRANSOCEANIC COMMUNICATION

Sound Foundations Laid for Technical and Financial Expansion—Signal Strength, Noise Obstruction and Advances in Loud Speakers Discussed

THE substitution of engineering analysis for reliance upon empirical methods in radio telephony and telegraphy featured the third technical session, which was held on Wednesday morning under Chairman Blackwell, after an introduction by President Jewett. Marked progress in transatlantic communication by radio and in measurements of signal strength and volume of noise obstruction were emphasized, together with gratifying advances in the unification of telephone-cable repeater apparatus. Important studies of "loud-speaker" design and the need of further research in this field were also brought out and discussed at this session.

Guesswork Abandoned

The expansion of the transoceanic communication system of the Radio Corporation of America from a few isolated plants to a unified group of electrical installations, all controlled for communication purposes from a central traffic office in New York, was described in a paper by E. F. W. Alexanderson, A. E. Reoch and C. H. Taylor. The authors also summarized the technical conditions covering the design of the "radio central" station on Long Island and those to be met in operating efficiently a modern radio communication system. Multiple reception of telegraph waves from all European transmitting stations is now achieved with a single antenna.

The extraordinarily high resistance of the quartz sand in the Long Island soil has been overcome by a buried network of 150 miles of wire. The working voltage of antenna has been increased from 60,000 to 150,000 by careful design, although above 135,000 volts corona losses are close to the line of insulation reserve. Provision for melting sleet from antenna wires has been made. By using a wave antenna remarkable success has been attained in suppressing atmospheric disturbances and in securing directive reception.

Transatlantic Radio Telephony

A new method of transatlantic radio telephony using a single side band with eliminated carrier formed the subject of a paper by H. D. Arnold and Lloyd Espenschied. With this method the narrowest possible band of wave lengths in the ether is used; all the energy radiated has maximum effectiveness in message transmission, and the stability of transmission is improved. An important element of the high-power transmitter is a water-cooled-tube installation by which the power of the transmitted currents is amplified to the order of 100 kw. or over.

The direct-current power for these tubes is supplied from a 60-cycle source through water-cooled rectifier tubes. A highly selective and stable type of receiving circuit has also been developed. Curves included with the paper present the most accurate and complete data of the kind yet obtained for transatlantic radio.

Frequency Measurement in Electrical Communication

J. W. Horton, N. H. Ricker and W. A. Marrison considered the need for increased accuracy in measuring any frequency between one and several million cycles per second and described a tuning-fork apparatus with vacuum-tube equipment for this class of work which has given excellent results. Data were given upon the effect of temperature, potential of power supply and circuit constants upon frequency, determined either by comparisons with a constant frequency or by ascertaining the absolute value of the frequency. The ratio of the rate of the fork to that of a carefully modulated clock has been found to be constant within six parts in one million over considerable periods of time. For measuring the frequency of any alternating current used in electrical communication in terms of the known frequency there has been developed an arrangement of harmonic producers and a special modulator-rectifier circuit for combining known harmonics of the base and comparing other frequencies with them.

Following the presentation of this paper, Mr. Horton stated that an agreement as close as 25 cycles in one million had been observed between the transmitted standard frequency of the United States Bureau of Standards and that of the apparatus described by the authors.

Telephone Equipment for Long Cable Circuits

The use of lead-covered cables in place of bare wires for long-distance telephone lines has been an important development of recent years, and a paper by Charles S. Demarest gave a comprehensive résumé of the latest practice in repeater assembly, testboard and signaling equipment, emphasizing the importance of compactness, standardization of dimensions, uniformity in assembly and mounting of units, together with the need of careful correlation of electrical and mechanical requirements.

More Research Needed in Electrical "Loud Speakers"

Much interest was shown in a paper by A. Nyman on electrical loud speakers which reviewed the mechanical and electrical essentials of this device and briefly described present forms and methods of developing and testing. The telephonic receiver, moving coil, inclosed armature and relay types were shown. The use of a condenser transmitter pick-up, with vacuum-tube amplification and resultant current measurements by milliammeter, with provision for voltage check, were described. The art of "loud-speaker" design is extremely new, but eventually it is expected that a horn or a vibrating structure can be designed with the same facility as an electric motor, since a loud speaker is in reality a motor,

though with a less tangible load than that of most motors. Considerable acoustic research, mechanical analysis of vibrating structures and investigations of the effects of vibrating parts in an electromagnetic structure must be done in this field.

E. W. Kellogg, Schenectady, N. Y., in discussing the Nyman paper, submitted a proposed test code to facilitate interlaboratory comparisons of loud speakers. This recommended that the oscillator be equipped with a filter to eliminate overtones and that a tone trap be provided in the amplifier for the same purpose; that the test room be not less than 15 ft. square and 10 ft. high, with three walls heavily damped and the fourth hard; that the transmitter be mounted 6 ft. from the loud speaker, the latter being at the middle of the hard wall and 6 ft. from the floor, and that results be expressed in dynes per square centimeter sound pressure per volt-ampere supplied to the instrument.

Dr. A. E. Kennelly said that while the paper offered a valuable means of rapid analysis, the motional impedance circle would appear to yield more scientific results. These studies are complex, but each year now produces the development of a dozen former years. W. H. Martin pointed out that a loud speaker should produce none other than the imposed frequency. In his opinion the important problem is how properly to transform the mechanical motion of the loud-speaker diaphragm into sound. In testing the effect of harmonics in the applied current is bad unless more careful provision is made for their removal than appears in the paper.

Closing, Mr. Nyman said that acoustic tests would probably always be needed in acceptance trials of loud speakers. He favored standardized tests, but felt that the details proposed by Mr. Kellogg should be modified somewhat. A sine wave test is excellent, but the tester cannot get along without a tone filter. It might be more desirable to mount the loud speaker according to anticipated service conditions than in a rigid position as specified. Both directional loudness and energy loudness measurements are needed.

TECHNICAL COMMITTEE REPORTS

Protective Devices, Industrial Power Applications, Transmission and Distribution Practices and Power Station Improvements Receive Major Consideration

TWELVE technical committees made their annual report regarding progress during the past year at the session on Wednesday evening and submitted suggestions for future work. These reports were on protective devices, electrophysics, marine practices, industrial and domestic power, instruments and measurements, transmission and distribution, lighting and illumination, power stations, electric machinery, telegraphy and telephony, education, and electrochemistry and electrometallurgy.

Protective Devices

Particular attention in the report of the protective devices committee, of which H. R. Woodrow is chairman, was directed to oil circuit breakers, switches and fuses, reactors, lightning arresters, grounding systems and relays. Establishment of relations with the British oil-switch research committee and other foreign committees of a like nature has been undertaken, and B. G. Jamieson is now in Europe for this purpose.

According to the answers to the questionnaire sent out by the sub-committee on reactors, nearly all failures of these instruments have been confined to installations which have been made for several years. The latest designs are much better mechanically and electrically. Manufacturers are prepared to build reactors for any voltage in use today, it was announced. Tests show that a resistor shunting the reactor reduces the overvoltages which arise from the inductive kick. Operating companies, it was pointed out, are beginning to realize the importance of installing reactors having a greater thermal capacity than formerly.

Progress toward the preparation of a specification for lightning arresters was announced by the sub-committee on this subject.

The investigation of the sub-committee on grounding has developed that there is still a wide divergence of opinion as to the proper manner in which to ground a given transmission system, that systems of different characteristics require different treatment, and that special problems arise from time to time in connection with the operation of the grounded and ungrounded systems. Data are being collected which will permit an analysis of simultaneous cable failures and protection of high-voltage cable.

The chief activity of the sub-committee on relays has been the preparation of the "Relay Handbook," which will describe all schemes of proved merit.

Marine

There has been evidence during the past year, the marine committee (S. A. Pierce, Jr., chairman) stated, that ship owners and operators are beginning to realize not only the saving in fuel but the saving in maintenance, the increased speed and precision which can be obtained by the use of electrical auxiliaries. Considerable work has been done in standardizing fixtures and appliances and in modifying existing rules on power apparatus. No attempt will be made at present to take up standardization of electrical propulsion apparatus, it being now in a formative state.

Industrial and Domestic Power

Interest in industrial and domestic power is chiefly based on ideas of general economy rather than on purely engineering considerations, the committee on this subject (H. D. James chairman), asserted. The great problem which leaders of industry are facing is increased production per person in order that more goods may be produced with fewer hours of productive labor per workman. Output has been very greatly increased during the last twenty-five years by the substitution of the electric drive for the steam-engine drive. By far the largest factors contributing to the success of the electric drive have been the improvement in control apparatus and the development of new and improved methods of mechanical drive. Power-factor correction is attracting considerable attention, being undertaken through the more careful application of motors rated at close to the normal load. The application of the synchronous motor has been materially widened by the use of the magnetic clutch and by the new synchronous motor, which can develop a starting torque equal to its pull-out torque. Improved forms of automatic starting devices are being placed on the market for induction motors in increasing numbers, and the tendency seems to be toward push-button control. Voltage control as a method of controlling direct-current motors is rapidly coming to the front, as is likewise sectional drive for paper machines. The electric drive has practically superseded the small steam turbine for the operation of power-house auxiliaries.

Recently an adjustable-frequency system of control has been used for woodworking machinery, and a source of low-frequency power has been used to permit the low speeds necessary in threading paper into paper calenders. The development of the electric-steam generator has made possible the complete electrification of mills utilizing process steam, although its use cannot be justified in all cases.

Instruments, Measurements and Electrophysics

This year it was decided to go ahead with the actual work of preparing what is hoped will develop into an American standard for electrical measuring instruments, the committee on instruments and measurements (G. A. Sawin, chairman) reported. During the past year there have been developments in alternating-current demand meters, very small synchronous motors, volt-ampere meters, small switchboard instruments and other appliances. Numerous European developments were reported by the committee.

The electrophysics committee reported, through its chairman, F. W. Peek, Jr., that the greatest interest in electrophysics appears to be concentrated in researches on the constitution of matter and the structure of the atom.

Transmission and Distribution

Cable research, construction problems, cable-testing and inductive co-ordination constituted the major subjects discussed in the report of the transmission and distribution committee (E. B. Meyer chairman). It was reported that an investigation into the maximum permissible temperature for impregnated paper insulation which is being conducted by the Massachusetts Institute of Technology is progressing favorably. The present indications are that manufacturers will ultimately be able to offer customers high-voltage cables with just as low a dielectric power factor as any heretofore furnished and at the same time with a materially higher dielectric strength.

An arrangement has been made with the Harvard Engineering School to make an investigation into the subject of ionization loss and ionization in high-voltage cables. Two of the larger operating companies with stations on both sides of their respective cities are seriously considering plans for high-voltage tie lines between their generating stations. Changes in joint construction which will materially reduce the length of the joint are necessary for higher voltages, the committee asserted.

Commenting on transmission distribution construction, the committee pointed out that with the increasing scarcity of certain timbers heretofore widely utilized for poles, there is evident a further increase in the employment of steel structures and more attention to improved methods of timber preservation. Insulator manufacturers have continued to improve materials, processes and designs with most satisfactory results. Warning against too rigid a form of attachment of conductors to insulators, the committee pointed out that too rigid a clamp may result in breakage of the conductors and even in serious depreciation of the insulator heads. For some extra-long spans bronze cables are being experimented with and new types of weatherproof insulation have quite recently appeared. There is a continued tendency toward standardization of minor details in line hardware. During the past year several new types of line switches have appeared on the market, and many satisfactory types are now available. New and improved devices for series street lighting are coming on the market. While higher-voltage distribution continues to increase, 2,300-volt and 4,000-volt systems remain the general standard. The rural-line problem continues to be one in which economic considerations are paramount. Some of the causes of trouble on underground cables have been studied and definite remedies have been found.

Probably the outstanding result of the year in inductive co-ordination was the publication of the third report of the engineering sub-committee of the joint general committee of the Bell Telephone System and the National Electric Light Association, the committee declared.

Lighting and Illumination

Many new lighting installations are being made and old ones are being revamped with a tendency toward higher standards of illumination, reported the committee on lighting and illumination, of which G. H. Stickney is chairman. Considerable experimentation to develop so-called gaseous-conductor illuminants has been reported. School lighting, store lighting and theater and art-gallery lighting are continuing active. Surveys of industrial lighting practice have been reported. For a number of years horticulturists have evinced interest in the application of artificial light to the control of plant growth.

Telegraphy and Telephony

Machine switching, submarine-cable telegraphy, long-distance radio telegraphy and telephony and printing telegraphy had special consideration from the committee on telegraphy and telephony, under the chairmanship of O. B. Blackwell. It was pointed out that the year has been marked by a considerable increase in the number of machine-switching telephone central offices. Several of the Western Union Telegraph Company's transatlantic cables are now being operated directly between New York and London. On Jan. 14, 1923, a group of about sixty people gathered in London and listened for two hours to speeches transmitted by radio from America. Since atmospheric disturbances constitute one of the principal limitations to long-distance radio, a great deal of effort has been directed toward finding methods of reducing their effect. The interest in radio-telephone broadcasting has steadily developed. In addition to increasing the number of its multiplex printing-telegraph circuits, the Western Union Telegraph Company has put into service a number of "forked-series" circuits of this class.

Education

Significant movements have been inaugurated both in the colleges and in outside circles looking toward better co-ordination between preparatory training and professional education on one hand and between professional education and industrial demand on the other, the educational committee, of which W. E. Wickenden is chairman, reported. The deans of fourteen engineering colleges in the Middle West have agreed upon a four-year engineering curriculum composed chiefly of fundamental and humanistic subjects with a fifth year mostly or wholly technical. The first four years lead to a bachelor's degree and the fifth year to an advance degree in engineering.

Power Stations

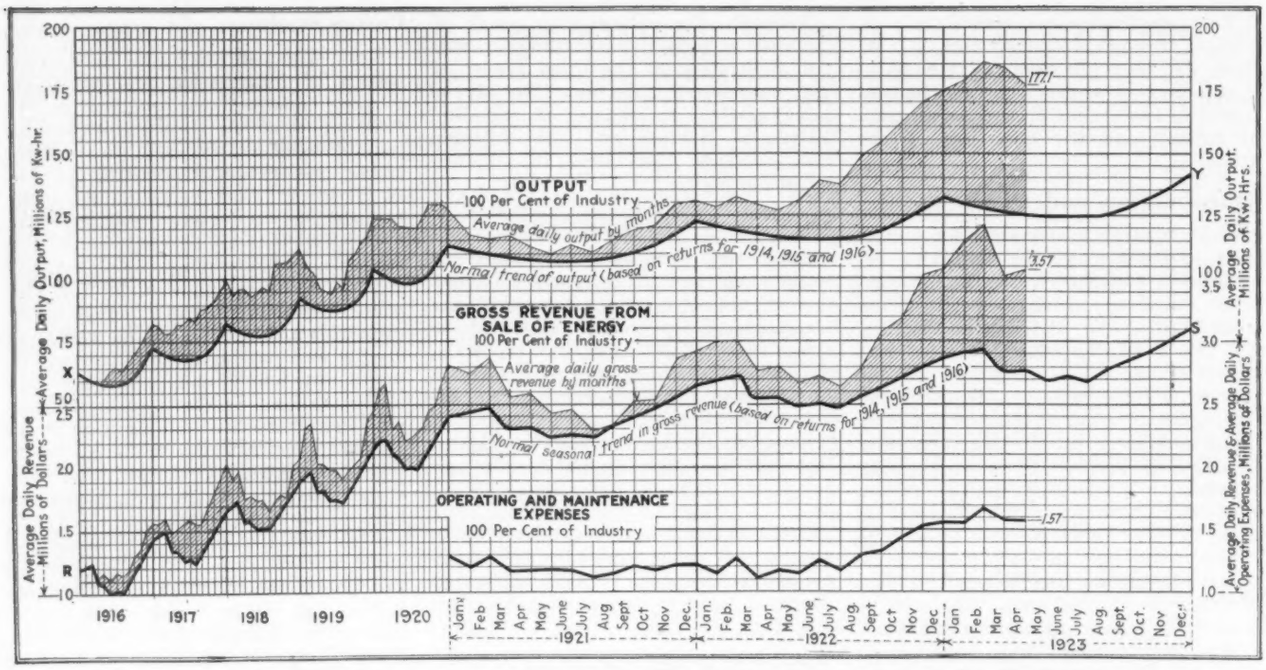
Particular reference was made to the wealth of information and detail regarding power-plant progress in the 1923 report of the electrical apparatus committee of the N. E. L. A. and the power generation committee of the A. E. R. A. Certain points were emphasized by the power stations committee (Nicholas Stahl chairman). For example, the committee pointed out that it is not improbable that the present tendency toward higher steam pressures and superheats, as well as of suggestions looking toward furnaces in which refractory material is substantially replaced by water-tube surfaces, may bring about a unit type of power station from the boiler to the bus which will have material influence on generator design. As it is important to keep the initial investment in a hydroelectric installation to a minimum, a more general appreciation of the influence of the flywheel effect on the initial cost will be beneficial to the industry, particularly in the case of low-head plants of moderate and small capacity. Small isolated, automatic low-head hydro-electric plants are becoming of increasing importance as they offer an economic and cheap means of developing the country's water power. Many companies have installed apparatus to fight fire by means of water or steam, and at least two have conducted extensive tests on the effect of injecting inert gas into a closed-circuit system to smother incipient fires.

Development in generator voltage regulators was reported, reference being made to the rheostatic type as well as the broad-range, vibrating type. Interesting equipments of centralized control apparatus have been built for automatic substations and hydroelectric generating stations in which one pair, or in some cases two pairs, of telephone wires are used to transmit the impulses or signals.

Synchronous condensers have come into general use for long transmission lines, and the installation of automatic hydro-electric power has been signalized by the Searsburg (Vt.) station.

The chief advance in disconnecting switches has been the development of improved types of mechanical interlocks of disconnecting switches and their associated circuit breakers. For the first time benchboards have been constructed of metal instead of the slate or stone previously used. A general tendency has also developed to provide a terminal room for all control cable and wires reaching to the switchboard so that utmost flexibility, ease and speed may be had in inspection and repair or replacement.

The increasing use of radio by power companies for the transmission of intelligence between stations and outlying districts and for the general purpose of load dispatching has led many engineers to think that future system intercommunication will be accomplished altogether by the means of radio.


OUTPUT
100 Per Cent of Industry
Average daily output by months
Normal trend of output (based on returns for 1914, 1915 and 1916)
177.1
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily gross revenue by months
Normal seasonal trend in gross revenue (based on returns for 1914, 1915 and 1916)
3.57
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
1.57
Average Daily Revenue — Millions of Dollars
Average Daily Output, Millions of Kw-hr.
Average Daily Revenue & Average Daily Operating Expenses, Millions of Dollars
Average Daily Output: Millions of Kw.-Hrs.
1916
1917
1918
1919
1920
1921
1922
1923

THE AMOUNT OF ELECTRICAL ENERGY CONSUMED BY CENTRAL-STATION CUSTOMERS DECREASED DURING APRIL, BUT THE GROSS REVENUE INCREASED

Seasonal Decrease in Output During April

REPORTS received by the ELECTRICAL WORLD for the month of April from central generating and distributing companies representing 73 per cent of the installed generator rating of the country indicate that the average daily output was about 4 per cent under that reported for March. This drop in energy consumption is undoubtedly accounted for by the advancing season and consequent reduced requirements for lighting purposes.

The average daily output during April was 177,133,000 kw.-hr., which, while almost 7,000,000 kw.-hr. below the figure reported for March, was 26.5 per cent in excess of that reported for April, 1922. Government figures indicate that industrial activities during April were about on a par with those of March, and the decrease in energy requirements must, therefore, be attributed almost wholely to the cause already named. The average daily revenue from sales of energy during the month was $3,573,000, which was slightly above the figure reported for March. A falling output and a rising revenue is a most favorable condition for any industry. It is probable that some portion of this revenue is a hang-over from the large amount of energy

TABLE I—CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
Feb....	72	3,733,633	2,918,626	28.0	68	$74,695	$61,838	20.8
Mar....	72	4,108,373	3,236,954	27.0	68	74,209	61,507	20.6
April..	73	3,879,288	3,065,251	26.5	68	72,912	60,788	20.0

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined Systems of Steam and Hydro 1922
Feb....	56	26,139	21,520	21.4	46.0	46.1	24.0	26.6	42.0	41.2
Mar....	56	27,457	22,314	23.0	46.8	48.3	23.6	27.1	42.5	40.7
April..	56	26,324	21,169	24.4	48.2	49.0	30.8	28.8	44.7	42.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	New England States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	Atlantic States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	North Central States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	South Central States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase	Pacific and Mountain States: Percentage of Installed Ratings Represented	1923 Thousands	1922 Thousands	Per Cent Increase
KW-HR. OUTPUT:																				
Feb.....	72	295,811	227,309	30.1	75	1,410,596	1,089,617	29.6	70	1,186,475	924,837	28.2	55	184,157	136,619	34.8	87	656,594	540,244	21.5
Mar.....	73	322,180	247,522	30.2	75	1,552,684	1,211,447	28.2	70	1,311,500	1,036,947	26.5	55	194,070	150,926	28.8	86	727,939	590,112	23.4
April....	73	300,314	225,002	33.4	75	1,460,816	1,128,704	29.4	70	1,228,953	986,660	24.6	55	187,268	139,481	34.2	86	701,937	585,404	19.9
REVENUE:																				
Feb.....	72	$7,954	$6,716	18.4	70	$29,336	$24,343	20.6	59	$22,255	$17,674	26.0	55	$5,130	$4,393	16.8	87	$10,020	$8,713	15.0
Mar.....	73	7,778	6,256	24.4	70	29,266	24,286	21.1	59	21,558	17,670	24.2	55	4,762	3,960	20.2	86	10,445	9,335	11.9
April..	73	7,458	6,157	21.1	70	28,734	23,795	20.8	59	21,467	17,587	22.1	54	4,666	4,092	14.0	86	10,587	9,157	15.6
OPERATING EXPENSES:																				
Feb.....	43	$2,302	$1,808	27.4	54	$9,021	$7,543	19.6	49	$8,957	$6,956	28.8	55	$2,395	$2,073	15.5	86	$3,456	$3,402	1.6
Mar.....	44	2,375	1,822	30.3	54	9,884	8,035	23.0	48	9,274	7,212	28.6	54	2,255	1,932	16.7	85	3,669	3,313	10.8
A ril....	44	2.102	1,635	28.6	54	9.722	7,636	27.4	48	8,789	6,808	29.1	54	2,193	1,881	16.6	85	3,518	3,239	9.7

sold during March. In fact, it is very doubtful if there is any direct comparison between gross revenue and output for any one month. Output will, of course, be reported direct from the generating plants, while the revenue must wait the payment of bills by customers. Another most favorable aspect of the April report on revenue is that the average daily revenue was 20 per cent above that reported for the same month last year.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to the gross revenue from the sale of energy, shows that the industry is practically on a par financially with 1922. The operating ratio reported for April by companies having steam plants only, taken in the aggregate, was 48.2 per cent, against 49.0 per cent for April of last year. It is encouraging to note that whereas during the first four months of last year the seasonal increase in the operating ratio was 3.7 per cent over that of the previous January, in 1923 the increase was only 0.5 per cent for the same period.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Working for Unborn Generations

To the Editors of the ELECTRICAL WORLD:

Not long ago the death by suicide of a prominent professor of physics was reported in this paper. He was a man of about sixty, well known in this country and abroad for his splendid contributions to mathematical physics and for several noteworthy devices invented by him. A generation of American physicists has grown under his direct or indirect influence, and the United States government called upon him to fill a responsible post during the war. Yet in his last note he expressed the feeling that his professional career was a failure. Deeply as his untimely death is to be regretted, it may be hoped that it will at least serve as a lesson and point a different way out for those original thinkers who feel that their contributions to the welfare of humanity are not appreciated by their contemporaries. May it also supply food for thought to those whose duty it is to see to it that advanced workers in science receive at least some patting on the back now and then.

When we look back upon the past ages of humanity we find that great scientists have worked mainly for future, then unborn, generations. How much did the contemporaries of Galileo, Newton or Ampère benefit by their discoveries as compared with the boundless blessings that came to later generations? The way out for our original thinkers is to keep this experience in the history of humanity constantly before their eyes and to learn to find their life satisfaction in the work itself and in the faith that it will benefit future generations. Just suppose that by some imperial edict we were forced to assimilate immediately all the advances in the various sciences and to apply them at once in our industries and in our mode of thinking. Life would become such a burden that many of us plain folks would be forced to suicide, instead of unappreciated geniuses.

Let our advanced workers in science take the position that most of their discoveries are for the future generations, which will erect them monuments and name streets in their honor. All that these workers need to attend to is to see that their essays are either published or at least deposited with a proper "undying" institution in manuscript form. Then let them be human outside their working hours and let them enjoy in common with the rest of us the little pleasures of friendship and sport that fate has kindly placed at our disposal.

Correll University,
Ithaca, N. Y. V. KARAPETOFF.

What Is Meant by Relay Maintenance?

To the Editors of the ELECTRICAL WORLD:

The importance of protective relay equipment is beginning to be more fully appreciated by operating companies since more attention is being given to relay application and maintenance than has been the case heretofore. Some companies have already established a system of routine, checking and recording the performance of relays, the work in many cases being under the supervision of their meter departments. Most of this work, however, covers only alternating-current protective relays, and while these are the most important, there are a large number of other classes of relays that are still receiving the same amount of systematic attention that the alternating-current protective relay received in the past—which was usually none!

The Cleveland Electric Illuminating Company has for a number of years past maintained a separate relay maintenance division of the operating department under the supervision of the chief operator, which takes care of the maintenance, testing, checking and calibration of all relays that are in use, both alternating and direct current. These include, of course, all excess current and directional relays, all series overload trips on low-tension oil switches, all protective or other relays such as overspeed devices, all signal or alarm relays, all relays used on automatic or remote-controlled apparatus and all contact-making voltmeters and auxiliary relays for the control of the automatic feeder-voltage regulators with which all lighting and some power feeders are equipped.

In short, the work of the relay maintenance division covers any and all relays that are in use on the transmission and distribution systems and also in the generating stations and substations. The total number shown by the relay record system is in excess of 2,700 and includes twenty-four classifications. It will be seen that a large share of this is work not ordinarily associated with relay maintenance but just that portion which in the past was "everybody's business" and therefore all too often "nobody's business." The responsibility for failure could never be placed because "nobody" was responsible. A systematic and orderly method of maintenance and records fixes this responsibility and furnishes a basis for judging the performance of the equipment. Any scheme of maintenance to be of real value must be sufficiently broad in its scope to take in any kind of relays that are likely to be used. The field of relay application and maintenance is much too broad to be confined to two or three types or classes and our early recognition of this fact has been more than justified by the results obtained.

Cleveland Electric Illuminating Company,
Cleveland, Ohio. A. H. NICHOLSON,
Chief Operator
Electrical Department.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Testing and Inspection of Relay Systems

Routine Maintenance Schedules and the Keeping of Records of Utmost Importance in Modern Protective Systems

IT IS highly important that after relay protective systems are installed and in service regular routine tests and inspections be made, for without this the most carefully planned system of protection is practically useless.

At intervals of from two weeks to a month, depending upon the importance of the relays, they should be operated electrically to make sure

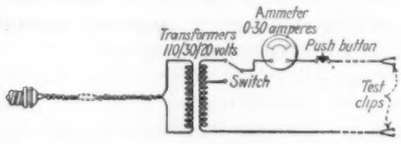


FIG. 1—BELL-RINGING TRANSFORMER FACILITATES RELAY TESTING

that they will function properly when required to do so. This test can be carried out very easily if the circuit breakers controlled by the relay are not in service, by closing them and applying current, as described below, to the relay terminals so that it will trip the circuit breakers.

If two breakers, one for each bus, are on a line which cannot be taken out of service, this test may have to be carried out on one breaker at a time by having the relay trip wire on the breaker which is carrying the load current open during the test. The load should then be changed to the other bus and the second breaker tested. Every precaution should be taken to make sure that the trip wire is closed after the test. As a rule no difficulty is experienced in making the various circuit breakers available for this check, particularly where the double-bus system is used throughout.

The test referred to in the preceding paragraphs can be easily carried out by applying current to the relay terminals by means of a small test set which consists essentially of a bell-ringing transformer connected as shown in Fig. 1. This device can be plugged into any lighting receptacle to obtain the current for testing. The taps on the low-voltage side of the transformer can, if desired, be arranged so that the different voltages are available to test relays requiring either large or small operating currents.

This routine operation of the relays need not necessarily be made by an experienced relay man. If any failure to function is observed, it should be reported to the proper person, who can then make the necessary inspection and adjustments.

Once a year all relays should be gone over thoroughly by a competent relay man who is prepared to make all the necessary adjustments, minor repairs, etc., which may be needed. At this time the conditions in the immediate vicinity of the relay installation should be carefully noted, for even though they may have been satisfactory at the time of the installation of the relays, changes or addition of other types of equipment may produce very unsatisfactory conditions for the proper functioning of the relays.

After the inspection has been completed the setting of the relays should be carefully checked and corrected if necessary. It will, of course, be necessary to set the relays again if during the inspection any repairs or changes of any kind are made.

If difficulty is experienced at the time of faults in obtaining selective action of the relays, it would be a good plan, in addition to checking the settings at the time of their failure to function, to make a check just before the annual inspections are made. This will help to show whether or not the calibration of the relay is constant.

Complete data on the settings of the various relays throughout the system should be kept in some form, preferably in a card index. These cards should contain complete information on the setting actually given the relay as well as the date and the initials of the man who made the setting. A form made up along the

RELAY SETTINGS

STATION _____ APPARATUS NO. ____ RELAY TYPE ____

PHASE	CUR. TRANS. RATIO	MIN. OF CURRENT		CYC. FOR OPERATION		SET BY	DATE
		PRIMARY	RELAY	AT MIN. AMP.	AT—AMP.		

FIG. 2—COMPLETE DATA ON RELAY SETTINGS SHOULD BE AVAILABLE

general lines shown by Fig. 2 will no doubt be found satisfactory for this work. It will be noted that in this figure the card is shown which calls for records of the minimum operating current of the relay and the corresponding primary current and that the time of operation in cycles is called for, both at the minimum operating current and at some larger current at which the relays are set.

If it is decided to set relays with a current which causes them to operate on the flat part of the characteristic curve, then some calibrating current, such as 40 amp. or 50 amp., can be selected for all relays. If the setting is made in this manner, it is not important that the current have exactly the value selected for this nominal standard, and there is

RECORD OF _____ RELAY OPERATION

DATE	STATION	APPARATUS	RELAY TYPE	RELAY SETTING	NATURE OF FAULT	OPERATION		REMARKS
						INCORRECT	CORRECT	

FIG. 3—CARD RECORD FORM FOR NOTING ABNORMAL CONDITIONS

therefore very little to be gained by keeping a record of the exact current used for setting each relay. If the magnitude of the short circuits to be expected or other conditions indicate that it is advisable to set the relay on the sloping part of the characteristic curve, then the exact value of the current used when the time is measured is important and should be recorded in every case.

It is generally advisable to keep a complete record of abnormal conditions of the system, including information as to whether or not all relays functioned properly. These data are of considerable value in pointing out improper relay applications, faulty types of relays, or that the relay systems are not carefully kept in operating condition. Fig. 3 shows a card record form arranged for this purpose which classifies the data according to the type of relays.

Whether the service supplied by the utility is classed as satisfactory or unsatisfactory may under certain conditions hinge on whether or not relay applications are correctly made and have proper care. This fact, combined with the possibility of minimizing the damage to equipment at time of failure by means of relays, brings out forcibly the necessity of insuring proper functioning of relays.

RAYMOND BAILEY,
Assistant Chief Electrical Designer.
Philadelphic Electric Company,
Philadelphia, Pa.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Inspection and Care of Boiler Instruments

THE rules given below on the routine care and maintenance of boiler room instruments have been taken from the operating code of the Philadelphia Electric Company. They cover drafts, gages, CO_2 recorders, flow meters, V-notch meters and pressure gages.

DRAFT GAGES, OIL GAGES

1. Check daily for zero and replace leakage.
2. On becoming sluggish and dirty, tubes should be cleaned with kerosene and blown out with air.
3. Check every six months with standard gage.

GAGES OF THE PRECISION TYPE

1. Check the zero and scale at least monthly.

CO_2 RECORDERS

1. Blow out the sampling pipes daily and see that they are kept free from soot.
2. Replace the filtering material daily.
3. Check for zero daily.
4. Check for leaks daily.
5. Replace the caustic when necessary.
6. Check for accuracy, weekly, with Orsat and report the results to the plant test engineer.
7. Clean the machine externally weekly.
8. Clean internally every six months.

G. E. AND BAILEY FLOW METERS

1. Blow out the nozzle plugs and piping weekly, or more frequently if necessary.
2. Clean the meter externally weekly.
3. Clean the mechanism yearly.
4. Check the meter annually, or oftener if necessary.

REPUBLIC FLOW METER

1. Blow out the piping and plug every month.
2. Clean the meter externally weekly.
3. Clean internally and replace with new oil every six months.
4. Check the meter annually, or oftener if necessary.

NOTCH METERS

1. Check the zero monthly.
2. Check the clock and integrator monthly.
3. Lubricate when necessary.
4. Inspect the float annually for leaks.
5. Inspect the weirs for corrosion and change in level.

PRESSURE GAGES

1. Calibrate annually, or oftener if necessary.

Operating Street-Lighting Transformers

THE information given below relative to constant-current transformers for street-lighting service has been abstracted from the operating code of the Philadelphia Electric Company.

A constant-current transformer consists of a stationary primary coil and a movable secondary coil. When the secondary coil is closest to the primary coil there is a very small amount of magnetic leakage and the voltages in the primary and secondary coils are almost in the ratio of their numbers of turns. The design of the transformers is such that when the coils are separated considerable magnetic leakage takes place and the secondary voltage is correspondingly lowered. The automatic adjustment of the position of the secondary coil to give the proper voltage is accomplished in the following manner:

The secondary coil is equipped with a counterweight which does not quite balance the weight of the coil. The additional force required for a complete balance is produced by the repelling effect of the primary and secondary currents upon each other. The only current which will produce the proper repelling force for a complete balance at any position of the coil is the current for which the transformer has been adjusted. Should the current increase (or decrease), owing to a decrease (or increase) in the impedance of the external circuit, the repelling force will increase (or decrease), raising (or lowering) the coil and thereby lowering (or raising) the voltage until the current again reaches the adjusted value.

The adjustment for the desired current is made by varying the number of small weights provided on the counterweight.

When the transformer is shut down, the secondary coil falls to the end of its travel, since the counterweight alone cannot balance it. If it were left in this position, the closing of the primary oil switch at the next starting time would impress maximum voltage on the circuit and cause violent repulsion of the secondary coil. To prevent these effects the latch for holding the coils at their maximum separation is provided, so that the transformer may be started with the minimum current on the circuit and allowed to build up gradually to the adjusted value for that transformer.

Cost of Coal Crusher for Chemical Analysis

COSTS of installing a No. 00 Sturtevant rotary coal crusher of the motor-driven type for use in preparing coal for chemical analysis, as filed with the Massachusetts Department of Public Utilities expenditure records for 1922, are given in the accompanying table.

COAL CRUSHER INSTALLATION COST FOR LABORATORY WORK IN CENTRAL STATION

No. 00 rotary crusher	$390.00
Type KT 2-hp., 550-volt, 1,200-r.p.m., three-phase motor	59.75
Freight	4.53
Labor (outside company)	6.74
Foundation	2.90
Paint	0.71
Bolts	0.50
Electrical fittings	38.11
Company labor	59.04
Total	$562.28

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Concrete Reinforced Poles Not Favored

ACCORDING to tests of poles reinforced with a concrete collar around the butt, newly reinforced poles give a strength at the ground equal to, if not greater than, that of the original pole, according to L. B. Snyder of the Westchester Lighting Company, who presented a paper covering this point at the recent convention of the Empire State Gas and Electric Association at Utica, N. Y. Subsequently defects develop, however, such as shrinking of the pole within the concrete collar and troubles resulting from the accumulation of moisture. At best, this method postpones replacement of the pole only a few years, Mr. Snyder contended, and when replacement becomes necessary the added cost of removing and disposing of the concrete bases more than offsets the gain derived from the added pole life.

Mr. Snyder's conclusions were based on results obtained by the Westchester Lighting Company in experimenting with this method. In 1911 this company started to reinforce poles. A special gang was organized and worked extensively, concreting more than 300 poles each season for several years. Soon after some of the poles had been reinforced it became necessary to remove them owing to highway changes, and a pulling test was applied to see how efficient the reinforcement was. In several cases the pole broke off half way up and the concrete held intact. In other cases the concrete cracked but still held until the pole was pulled nearly to the ground. It was found by these tests, as already stated, that on newly reinforced poles the reinforcement gave a strength at the ground line equal to, if not greater than, the original pole.

Later tests developed, however, that some of the reinforced poles had decay at the heart. This was overcome by boring the butt before attempting to reinforce the pole, together with a liberal application of pole preservative on the pole after the decay had been removed and before the reinforcement was applied.

For a time this plan overcame the difficulties. Subsequently, however, the defects in the process began to develop. As the reinforcement aged the pole shrunk inside the concrete collar, leaving a recess in which water collected. This, together with the weather cracks or checks in the pole, allowed the water to seep down inside the concrete collar. Thus the concrete, while protecting the pole at the ground line, allowed the water to get in from above. Moreover, in a number of cases where the reinforcement appeared to be in perfect condition and where there appeared to be no possibility of water penetrating it was found that decay had taken place inside the concrete collar and that nothing held the pole but the reinforcing rods.

After reinforcement it was practically impossible to judge the true condition of an apparently good pole. A pole might seem to be sound, but in a great many cases it was found that a shell of wood so solid the inspector could not penetrate it with his bar covered a heart decay that left no strength in the pole whatever. Several seemingly good reinforced poles broke off, and serious and costly accidents due to the failure of one pole thought to be in good condition were narrowly escaped.

Assuming that the life of a pole can be prolonged five years by reinforcing, the financial comparison is as follows: Take the cost of labor and material necessary to concrete a pole, plus interest at 6 per cent for five years, together with the cost of removing the concrete butt when the pole is replaced later. Offset this by the first five years' depreciation of a new pole set now, plus interest at 6 per cent for five years on money spent for labor and material in setting a new pole and changing over.

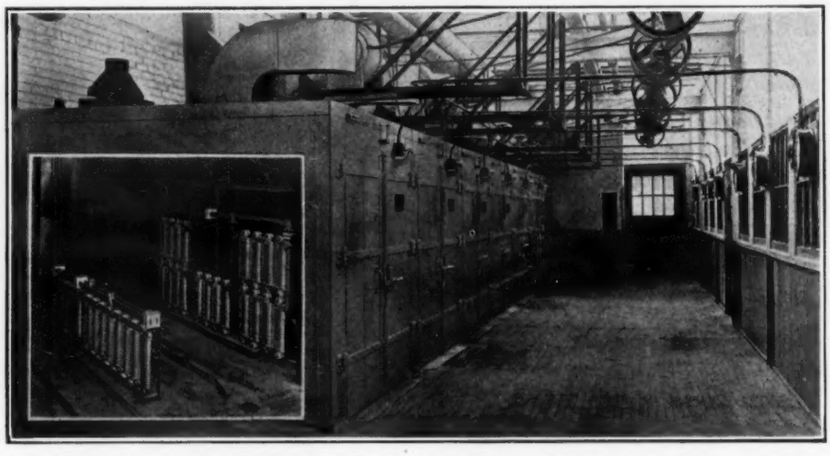
Because of the false sense of security imparted and increased opposition on the part of the municipal authorities toward the method, the Westchester company has found that the reinforcing of poles is not an efficient method of maintenance.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Rejection Reduced to 3 per Cent in Electric Oven

ELECTRICALLY heated ovens have been substituted for gas japanning ovens by the Ritter Dental Company of Rochester for japanning its products. These ovens form a total connected load of 280 kw., 230 volts, three-phase, and are used in japanning metal parts ranging in size from pedestals 5 ft. high to pieces the size of a watch. The temperatures used range up to 450 deg. F. according to the class of work being done.

The high finish that is required on the parts, which was difficult to obtain satisfactorily with gas ovens, caused the company to install the "electrics." The result has been that not only has the volume of production increased, but the number of rejections due to imperfect baking of parts has dropped from more than 20 per cent to between 3 and 4 per cent.



JAPANNING OVENS WITH HEATING ELEMENT SHOWN IN INSERT

In speaking of these ovens C. B. Lawrence, production manager, says: "We find the cost of operation is equal to that of the gas-burning ovens. However, since these ovens are controlled by recording thermometers and automatic regulators, we are able to hold a constant temperature and distribute the heat more uniformly and thereby reduce the spoilage.

"As a matter of fact, the percentage of spoilage due to overbaking or underbaking is practically nil. Knowing that our work is always baked at the same temperature naturally increases the quality of product. The baking time is less than that required with the gas ovens and thereby increases production during the same number of working hours. We should hesitate a long time be-

fore going back to the gas-heated ovens for japanning."

The ovens employed are rather large, owing to the size of some of the parts to be baked, the interior dimensions being 7 ft. x 7 ft. x 7 ft., with room for two truckloads of material at once. The heating units in each oven are disposed partly on the sides and partly on the floor of the oven in such a way as to give the most uniform distribution of heat throughout the oven interior.

The work to be baked is sprayed in the adjoining room, loaded onto the trucks and wheeled into the ovens. An interesting feature in the construction is that, in order to do away with vibration in the oven, the ventilating fans are mounted on platforms slung from the ceiling, instead of directly on top of the ovens themselves.

The control is automatic, the instruments being mounted on the wall opposite each oven, and the contactor panels and control switches are installed in a small room adjoining the oven room. In this control room the panels carrying the contactors, overload relays, etc., are mounted on one wall, while on the other are panels carrying double-pole double-throw switches for each oven, by means of which the heater connections are changed from Y to delta in order to obtain high or low heat, as desired. An interesting feature of the control system is a small panel mounted in the room with the ovens that is known as the main control panel. It carries a push-button switch and pilot light for each oven.

In operation, pulling the handle of any switch closes the circuit of the holding coil of the main contactor on that oven's control panel, causing the contactor to close and putting full voltage on the heating elements of the oven. At the same time, the red pilot light alongside of the switch is lighted, so that by merely glancing at the panel the operator can tell which ovens are in operation and which are not.

A further safety measure consists of a switch on the oven door which is opened when the door is opened. This switch on opening breaks the main circuit to the heaters and eliminates the danger of any one's coming in contact with the heating units when they are alive. The heating units and automatic control panels were furnished by the General Electric Company.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Types of Aërial Cables for Distribution

THREE types of aërial cables for power distribution or transmission are now being used, and considerable difference of opinion seems to exist as to their relative merits. It is believed that this difference of opinion is due mainly to the fact that each of the different types fits in with certain particular conditions and that, if the good and bad points of each type of cable are analyzed, it will become evident that the question of choice is not so much a matter of opinion as to the general superiority of one type over another, but should depend, rather, upon a study of local conditions.

The make-up of the three kinds of aërial cable is as follows:

1. Varnished-cambric insulation with rubber-filled cotton tape over the belt insulation, asphalted jute and two galvanized steel tapes applied helically.

2. Impregnated-paper insulation with the outer part of the belt insulation consisting of rubber fabric, somewhat similar to ordinary garden hose, to protect the paper against moisture, asphalted jute and steel-tape armor.

3. Paper insulation with lead-antimony sheath.

DESCRIPTION OF EACH TYPE OF CABLE USED

Type 1 is the most expensive of the three, but it is the lightest in weight. For very large three-conductor, 500,000 circ.mil, 13,000-volt or 350,000-circ.mil, 26,000-volt cables the question of weight becomes important. It may also be important where it is proposed to place a cable on an already heavily loaded line or one which might require a great deal of extra guying, replacement of poles or decrease of pole spacing if the heavier cable were used.

The disadvantages of this type are that it does not have the best of protection against moisture, that the dielectric losses with varnished-cambric insulation are higher than with paper, that steel-tape-armored cable cannot be pulled through supporting rings, and that it cannot be taken down and placed in underground conduit if later conditions of growth necessitate the abandonment of aërial construction.

Type 2 embodies the advantages of paper insulation and lightness and is intermediate in expense between types 1 and 3. The fact that the insulation is paper makes type 2 more desirable for the higher voltages, say above 13,000, than type 1. That is probably its controlling advantage, because in spite of its lower cost the greater difficulty of obtaining moisture-proof joints is a serious drawback. Type 2 aërial cable has, similarly to type 1, the disadvantage of not being suitable either for pulling through rings, because of the steel tape armor, or reinstalling in underground conduit. The manner in which this type of cable is made up, at least by some manufacturers, results in a greater diameter than that of either of the other types, which, under adverse sleet and wind conditions, seriously reduces the advantage of its initially lighter weight, especially in the smaller sizes.

Type 3 cable is the least expensive of the three, has the most efficient electrical characteristics, the most effective and durable protection against moisture, can be pulled through rings previously attached to the messenger wire, and is suitable for reinstallation in underground conduit. Its principal disadvantage is its weight, which may become serious with large cables or where it is attached to old weakened or insufficiently guyed pole lines or lines already carrying a heavy load or with long spans. Nevertheless, it should be remembered that many telephone lines carry several crossarms of open wires in addition to a very heavy cable.

Summarizing, it may be said that type 1 aërial cable should be used for the lower voltages (up to and including 13,000) and for large sizes where lightness is the prime consideration; type 2 for the higher voltages and large sizes where economy in weight is necessary, and type 3 in all cases where its weight does not exceed, let us say, that of a 350,000 circ.mil, three-conductor, 13,200-volt cable, which is the largest aërial cable now known to be in service. Type 3 will probably have a wider application than either of the others.

It may be of interest to know that, among the larger companies, type 1 is used by the Duquesne Light Company, types 2 and 3 by the Public Service Electric Company of New Jersey, and types 1 and 3 by the Westchester Lighting Company.

F. A. WESTBROOK,
Field Engineer.
Habirshaw Electric Cable Company,
Yonkers, N. Y.

Easily Manipulated System Diagram Saves Time and Uncertainty

AN EFFICIENT and inexpensive system diagram used at the Montville station of this company is illustrated herewith, an interesting feature being the use of different colors and thumb-tack applications for various symbolic representations of operating conditions. The diagram is mounted on a yellow-pine frame of stock 3½ in. square and is 8½ ft. long by 4 ft. 9 ft. wide, the bottom being about 2 ft. above the floor. The frame is mounted on casters and is thus readily portable. The background is of white-pine boards neatly matched and planed down to give the appearance of one piece. This was painted with several coats of flat white followed by two coats of enamel, each coat being sandpapered.

Feeders are represented by strips of white pine $\frac{7}{32}$-in. square fastened to the board by common pins with their heads removed. This facilitates making changes in the location of feeders without marring the board. These strips were painted before putting in place and extra strips are kept on hand. Blue strips represent 66,000 volts, dark gray 33,000 volts, brown 11,000 volts and buff below 11,000 volts. The number of each feeder is painted in white in several places along each feeder strip.

Transformers are represented by small blocks of wood $\frac{3}{32}$ in. thick and marked with a zigzag line of the standard voltage color for primary and secondary. Oil circuit breakers, disconnecting switches and generators are represented by colored thumb tacks. The oil circuit breakers utilize plain thumb tacks, red to denote the open and green to indicate the closed position. Disconnecting switches are of the same color as the oil breakers, but each has a white line across its face, this line being placed parallel to the feeder when the switch is closed and at right angles when open, giving a double check on the position of the switch.

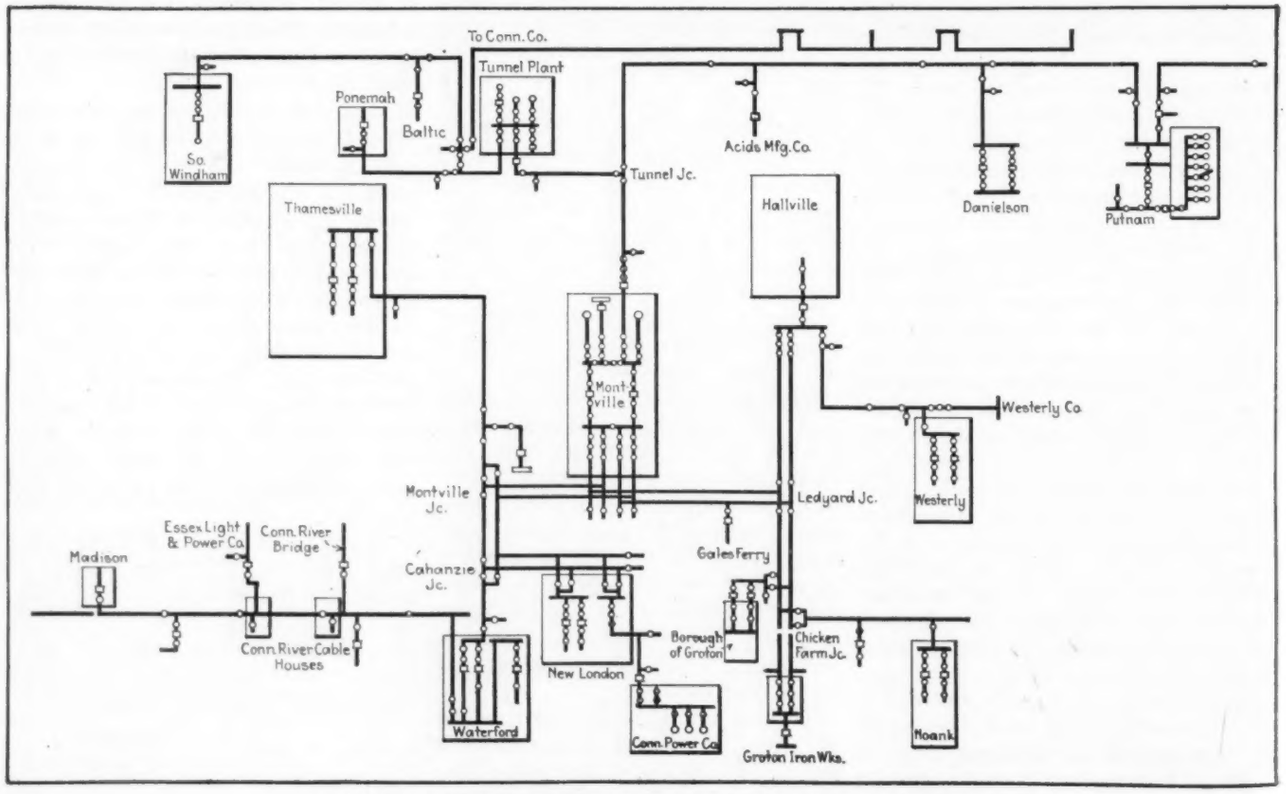
All switches are numbered, those in stations running from 1 to 99 and having the initial of the station before them. Those on the feeders are numbered in the same hundred as the feeder; i.e., switch No. 108 is on No. 1 feeder, and No. 208 is on No. 2 feeder. "Disconnects" in conjunction with oil breakers are lettered "A" and "B"; thus disconnects 100 A and 100 B are on either side of oil breaker No. 100.

Steam turbo-generators are indicated by black thumb tacks slightly larger than those used for switches, with the machine capacity lettered upon the top in white. Hydro-generators are shown by a plain nickeled thumb tack the same size as the turbo-generator tacks and similarly lettered. Rotary converters are represented by buff-colored thumb tacks and frequency changers similarly, except for a cycle sign on the face. Lightning arresters are shown by bright yellow map tacks.

The oil and disconnecting switches are easily changed, a supply of spare thumb tacks of the various denominations being kept at the lower right-hand corner of the diagram. All station buildings are outlined with thin strips of wood painted green.

A system of tagging switches in imitation of the actual tagging operation is carried out in connection with the diagram. Whenever a switch is ordered opened and tagged by the power director he immediately changes the thumb tack which represents the switch in question and also fastens under the thumb tack a small metal tag, which has a hole in one end for this purpose, painted red and bearing the number of the person for whom the switch is tagged. Every person authorized to order a switch tagged is given a number and has several of these metal tags hanging on the diagram directly under his name.

R. E. WATROUS,
Power Director.
Eastern Connecticut Power Company,
Norwich, Conn.



MANUALLY OPERATED SYSTEM DIAGRAM HELPS LOAD DISPATCHING

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Conditions Which Delay Prompt Service Connection

By J. B. Redus
Assistant General Manager Harrisburg (Pa.) Light & Power Company

ARTICLES appearing recently in the Electrical World showing the time required to give service after application has been made are of more than passing interest. They indicate thinking along the right lines, and this will result to the advantage of the utility companies. These articles have been read by a great many executives, officials, operating-department heads and employees of utility companies. They have, no doubt, also been read by consulting engineers, manufacturers of electrical equipment, electrical dealers and contractors. It would be surprising indeed if it had not occurred to a number that similar data should be compared for a period sufficient to show the average time applicants have waited for electric light or power service after application has been made.

A great deal of educational work has been done in past years by utility companies to bring the prospective consumer to consider and decide upon the use of central-station service at the earliest possible moment. In many instances, during the option period in the purchase of property, before the final transaction has been closed, if electric service is not available at the location, it is necessary to ascertain whether the utility will make the necessary extension, in order that the service shall be available when the prospective customer's construction is completed. This is an established practice among utilities and it has proved to be in the interest of both the company and prospective consumer. Comparisons, therefore, based upon the actual elapsed time between the signing of the application and the starting of service, should in such cases include the time necessary for the construction of overhead or underground extensions and the installation of the service connection from the main to the consumer's property, the time to obtain the necessary permits, insurance inspection and other requirements, as well as sometimes unavoidable delay in shipping material for such work.

Application for service must be made when convenient for the applicant, which, whether by telephone or upon call of solicitor or at the company's office, may be just before closing time on a day before a holiday or Sunday, or when a holiday immediately precedes or immediately follows a Sunday, thus greatly increasing the time between the application and the starting of the service, for it is unavoidable that the applicant shall be without electric service during that period.

For a period covering one year from May 1, 1922, to April 30, 1923, the Harrisburg Light & Power Company received and executed 1,540 applications for service where it was only necessary to set a meter. There were 3,154 applications for service where the meter was already installed and the service available for use. There were also 2,206 applications for service where it was necessary to make extensions of underground mains or of overhead distribution system, to construct an underground service connection from the main to the consumer's property or to run the service from the overhead-main extension to the consumer's property and install a meter. The territory served by the company is 17 miles long by 6 miles wide with a number of rural lines and considerable construction on farms or property of the applicants. In several instances during this period applications for power service were made where from two months to nearly a year was required for the applicant to make his own construction before service was started. The elapsed time which has been used in compiling these data includes all such periods.

Some time ago the company put in effect, for experiment, the plan of leaving the meters installed when customers discontinued the use of service. The main switch was opened and the handle secured by a meter seal. A colored card was attached to the bottom of the hall chandelier or other place in the main entrance where it could not but be seen stating that the service was available on the premises by closing the entrance switch and telephoning the company that service was to be used. The result of the experiment exceeded the expectations of the meter department, where the plan originated. The reduction in the work which would have been necessary by the meter department had these meters been removed made it possible to postpone taking on an additional employee. Not only was this saving made, but additional revenue was realized because of the service being available and used earlier than would have been possible had the meter been removed. Since this plan was first tried no loss has been suffered by failure of applicants to pay for the

A Customer's Appreciation of Service

Harrisburg Light & Power Company,
Harrisburg, Pa.

GENTLEMEN — The Harrisburg-Rockbond plant is now completed and going, and when we come to think of what has been accomplished on this operation, starting as we did from the ground up late in July, we realize that without good service and co-operation from those who had a part in the building and equipping of this plant the record established would not have been possible.

We wish to thank the Harrisburg Light & Power Company for the personal interest and attention shown us. The service provided by your company stands out as being of an unusually high order, thoroughly dependable and attentive in the little things—details which mean so much in the making or marring of service.

We, of course, realize Mr. K——'s part in making these things possible and sincerely appreciate his personal interest and attention in seeing that a promise made means its fulfillment. That's service.

service, and the plan has been permanently put in effect.

During this period 1,540 applications required setting of meters, and the elapsed time from signing the application to the time of starting service was 134,722 hours. For the 3,154 applications for service where the meter was already set and the prospective applicants started to use the service no elapsed time occurred. This means that 3,154 of 6,900 applicants had no delay in securing service. The 2,206 applications for service where extensions of underground or overhead system, including running service and construction of substation on customer's premises, were necessary required 798,112 hours.

These results may appear unfavorable as compared with the very short periods required by some utility companies, but they show how conditions created by the customer and over which the company has no control sometimes affect the length of time intervening between the service application and actual connection.

Customers as a rule appreciate prompt service and attention to their requirements, even though they do not always so express themselves to the company. However, the letter on page 30, showing the attitude of one customer who acknowledged the company's effort to serve, is not a solitary instance. In this instance a period of five months elapsed between the original application and the actual connection of the service.

Plans for Development of Industrial Heating

WHILE the load-building possibilities of industrial electric heating have been clearly demonstrated, there is still need for the enlightenment of many central-station executives as to its revenue-earning value. Lack of accurate data on actual installations and more or less unfamiliarity with the subject on the part of power engineers have tended to prevent a more rapid growth of this load. Within the last two years the N. E. L. A. Power Bureau has accomplished remarkable results through educational courses carried out with the assistance of manufacturers, and Wirt S. Scott, chairman of the industrial heating division, in his report at the annual convention in New York last month, recommended a program for the development of industrial heating along the following lines:

1. The continuation of the educational program either by means of a school or by some other similar method.

2. The active collecting of data for each new installation on central-station lines, the classification and compilation and then the broadcasting of these data.

3. Active cross-representation with other societies and organizations interested in the electric heating art.

4. Each central station should (a) at once train its men in the industrial electric heating art, (b) make a thorough survey of the industrial heating possibilities of its territory, (c) then go after and obtain the industrial electric heating business which will help the industrial establishments in the severe commercial competition of the future.

5. That the executives and managers of the many central stations give consideration to obtaining the capacity which will be necessary to supply the industrial heating load of their territories, as indicated by the results of surveys made.

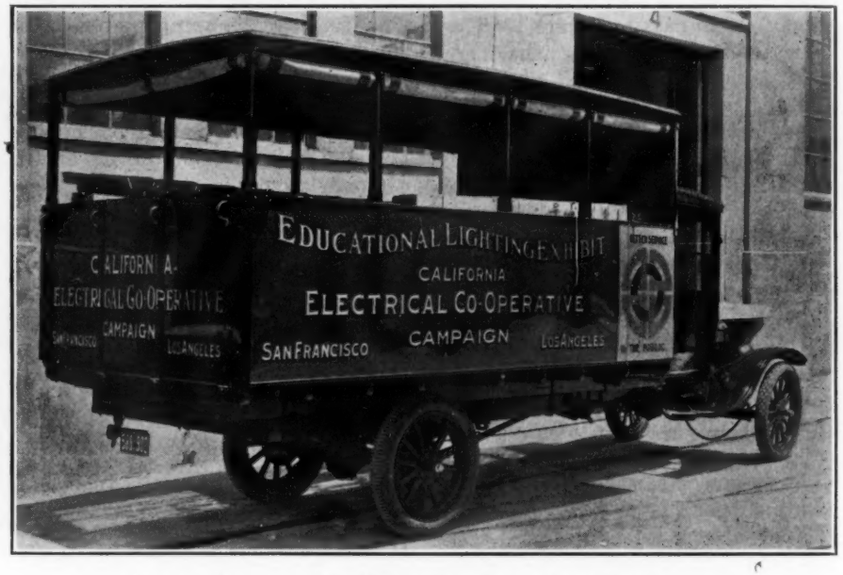
6. Each geographic division should hold a semi-annual industrial electric heating symposium in order that power and heating salesmen may become familiar with new developments and actual installation, become better acquainted with the problem of the heating art and exchange the data, sales ideas and methods used in the successful obtaining of heating business.

7. Each central-station power salesman should at once start a library for industrial electric heating information.

This condition makes it absolutely essential that the central stations have on their staff men who (a) have a knowledge of the fundamentals and principles of industrial electric heating, (b) are familiar with the apparatus on the market, their operating characteristics, limitations and adaptability to the process, (c) have an intimate knowledge of similar installations made in other parts of the country, and (d) have access to publications on industrial electric heating.

Portable Window-Lighting Exhibit

THIS portable window-lighting exhibit is being used successfully by the California Co-operative Campaign to stimulate interest in better display window lighting with great success. The exhibit, which was described on page 586 of the March 10 issue of the ELECTRICAL WORLD, has had eight showings before two thousand merchants in various cities of California, and the amount of new business derived is estimated at several thousands of dollars. To transport the exhibit around the state the Co-operative Campaign has recently purchased

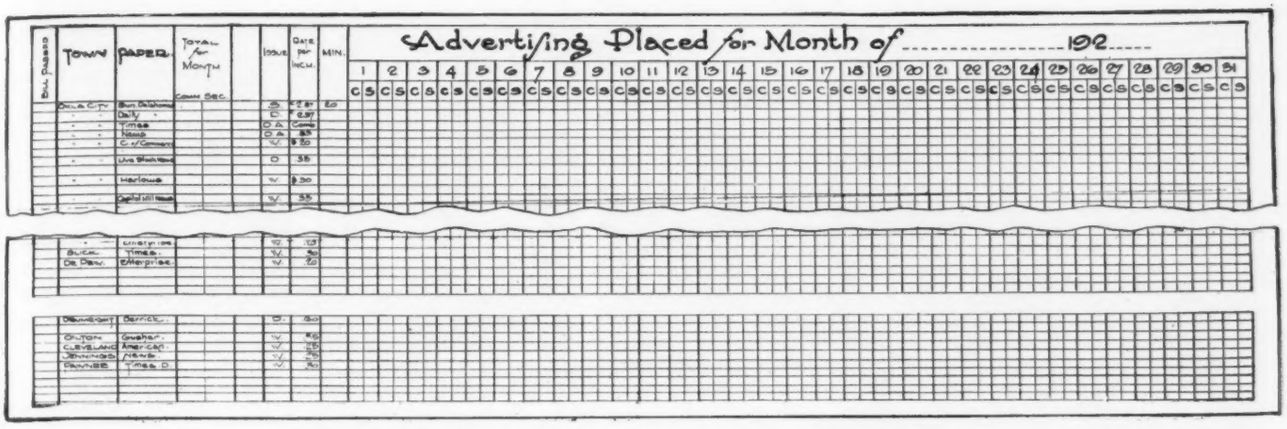


TRUCK FOR DEMONSTRATING PROPER WINDOW LIGHTING TO CALIFORNIA MERCHANTS

the truck shown in the accompanying illustration. The body of the truck is 6 ft. 3 in. wide and 12 ft. long and is designed to carry all equipment used in connection with the exhibit.

The exhibit is constructed after the fashion of stage scenery and can be assembled in a minimum of time. The lighting equipment is complete and of the latest type and includes a complete window trim of the highest quality. It is the usual practice to co-operate with a local merchant, obtaining from him the material to be displayed in the window at the time the lecture on proper illumination is given.

A field representative accompanies the exhibit and acts as chauffeur, stage hand, electrician, lecturer, illuminating engineer and salesman. In the larger cities the lecture is given by an illuminating engineer furnished by one of the manufacturers.



FORM FOR KEEPING MONTHLY RECORD OF ADVERTISING PLACED

Policies in Central Station Advertising

JUST what the advertising policy of a utility should be varies with different companies, if the expressions of utility men at recent conventions can be taken as an indication. What it is in the case of the Oklahoma Gas & Electric Company is not a matter of doubt to the man who takes the time to follow its ads in the communities in Oklahoma which it serves.

There is a very definite philosophy back of the advertising of the company. It is the same as that on which the general business of the company is conducted and may be stated as follows:

1. The company is a part of each community in which it does business.
2. It has a story that can be told only by advertising.
3. Newspapers are a part of the community and business life that it is the duty of the company to use for business purposes.

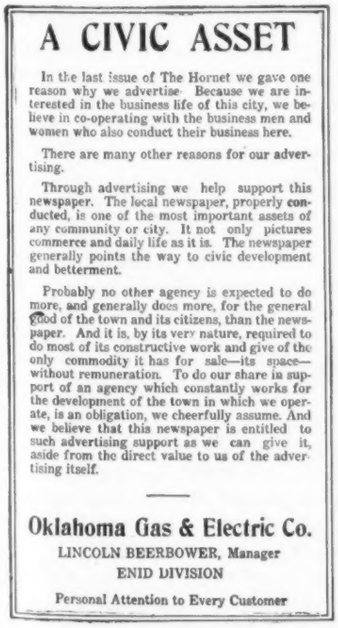
The two advertisements shown at the right and left below give the company attitude. These have been used in various local papers in the territory to answer questions that have been asked in regard to the use of advertising.

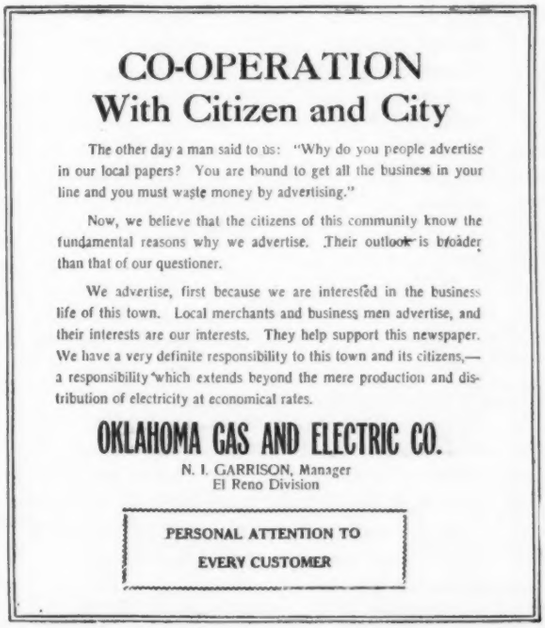
The company does no merchandising at the present time, so naturally does not carry on direct selling advertising campaigns. Its advertising is devoted to "selling" the company as a part of the community. Among other things it advertises the taking on of big or unusual loads as shown in the center below. Advertising of this kind seems less a company advertisement than is usual because care has been taken to tell about the others who are interested in the particular project and the place of the project in community affairs.

Another type of advertisement used is that telling of the process that is gone through when some occurrence that necessitates unusual methods and hard work in maintaining service is met. A few months ago a neighboring utility company met with misfortune in losing its plant by fire. The Oklahoma Gas & Electric Company by unusual efforts was able to supply the service in a short time, and this story was told in advertisements in a number of communities.

Advertising is also carried in papers in the towns where wholesale service is given. These "ads" are built around some subject showing the relation of the company to community affairs.

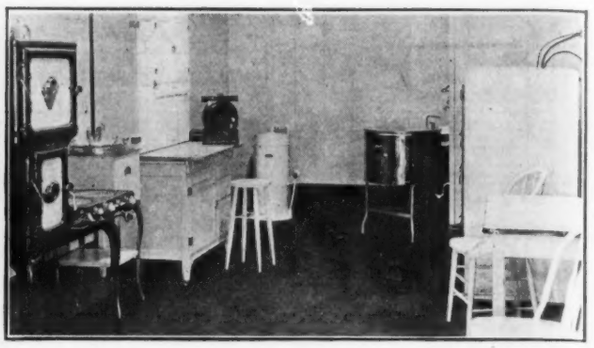
A complete record of the advertising placed each month is kept on the form shown above. This is supplemented by monthly district reports showing the total by districts and a consolidated summary for the entire system which is made up from a detail sheet shown.

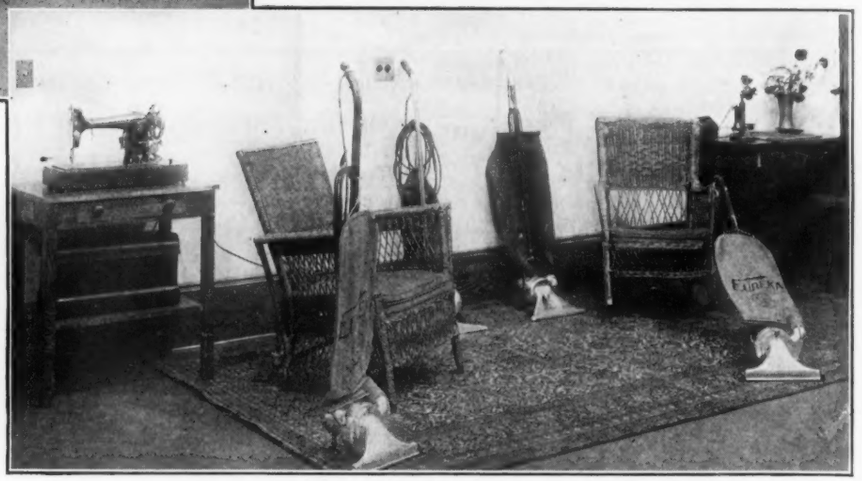

A CIVIC ASSET
In the last issue of The Hornet we gave one reason why we advertise. Because we are interested in the business life of this city, we believe in co-operating with the business men and women who also conduct their business here.
There are many other reasons for our advertising.
Through advertising we help support this newspaper. The local newspaper, properly conducted, is one of the most important assets of any community or city. It not only pictures commerce and daily life as it is. The newspaper generally points the way to civic development and betterment.
Probably no other agency is expected to do more, and generally does more, for the general good of the town and its citizens, than the newspaper. And it is, by its very nature, required to do most of its constructive work and give of the only commodity it has for sale—its space—without remuneration. To do our share in support of an agency which constantly works for the development of the town in which we operate, is an obligation, we cheerfully assume. And we believe that this newspaper is entitled to such advertising support as we can give it, aside from the direct value to us of the advertising itself.
Oklahoma Gas & Electric Co.
LINCOLN BEERBOWER, Manager
ENID DIVISION
Personal Attention to Every Customer


CO-OPERATION
With Citizen and City
The other day a man said to us: "Why do you people advertise in our local papers? You are bound to get all the business in your line and you must waste money by advertising."
Now, we believe that the citizens of this community know the fundamental reasons why we advertise. Their outlook is broader than that of our questioner.
We advertise, first because we are interested in the business life of this town. Local merchants and business men advertise, and their interests are our interests. They help support this newspaper. We have a very definite responsibility to this town and its citizens,—a responsibility which extends beyond the mere production and distribution of electricity at economical rates.
OKLAHOMA GAS AND ELECTRIC CO.
N. I. GARRISON, Manager
El Reno Division
PERSONAL ATTENTION TO
EVERY CUSTOMER

CONFIDENCE
IN OKLAHOMA
New State Ice Company's Modern, Fresh-Water Ice Plant, Now Under Construction, Second Street and Santa Fe Tracks, Oklahoma City.
TO BE THE LARGEST PLANT OF ITS KIND IN THE SOUTHWEST—THE LAST WORD IN ICE PLANT DESIGN AND CONSTRUCTION — TO USE EXCLUSIVELY, CENTRAL STATION ELECTRIC SERVICE FURNISHED BY THE OKLAHOMA GAS & ELECTRIC COMPANY.

ADVERTISEMENTS EXPLAINING A UTILITY'S POSITION IN A COMMUNITY AND THE APPLICATION OF ITS SERVICE





HOW SMALL FLOOR AREA IS UTILIZED TO GOOD ADVANTAGE

Effective Sales Arrangement in Limited Space

BY SUBDIVIDING its recently completed store into partitioned sections opening into the front of the office and facing the entering customer, the Pittsfield (Mass.) Electric Company has avoided the "jumble-shop" effect often encountered in central-station appliance departments and has separated socket devices into service classes for the convenience of customers.

In as small an area as 2,000 sq.ft. E. P. Dittman, sales manager, has established a demonstration of electric kitchen, sewing-room and living-room equipment utilizing the front portion of the office for the display of lamps, toasters, flatirons and table appliances. About fifty outlets are provided for demonstration and lighting service. The display area is illuminated by eight 200-watt units, fourteen 100-watt lamps being installed for window lighting.

What Other Companies Are Doing

Indianapolis, Ind.—For the first four months of 1923 the merchandise sales of the Interstate Public Service Company of Indiana were $95,446, an increase of 59.6 per cent over the corresponding period in 1922. During this period 1,665 new customers were added to the lines with an increased lighting load of 2,204 kw.

Louisville, Ky. — The Louisville utilities, including the Louisville Railway Company, Louisville Gas & Electric Company, Louisville Home Telephone Company and Cumberland Telephone & Telegraph Company, aided by the Louisville Automobile Dealers' Association, the Standard Oil Company and the Louisville Taxicab & Transfer Company, co-operated in advertising in the local papers to aid the campaign for Safety Week. These organizations freely inserted advertisements, 6 in. x 6 in., scattered through the local papers, calling attention to what can be and should be done to aid in reducing accidents.

Dayton, Ohio.—During the four weeks from April 18 to May 18 the Dayton Power & Light Company received applications for service from 221 new houses and 313 old houses, and there were 1,277 transfers, at the rate of forty-nine per day. Residential power was installed for ranges and refrigerators in thirteen instances. Twenty-five power customers were added, with an aggregate load of 234 hp.

Dallas, Tex. — The Texpolite Building & Loan Association has been organized here for the purpose of assisting employees of the Texas Power & Light Company to own their homes. The association is capitalized at $5,000,000 and the incorporators are James E. Van Horn, secretary and assistant treasurer of the Texas Power & Light Company; W. G. Schmauder and J. B. DeBow, also officials of the company. The association will operate at a lower rate of interest than is generally charged by such associations and is intended to be non-profit-making. Following establishment of this association it is planned to extend its operations to include employees of all the subsidiary companies.

Boston, Mass. — Twelve electric utilities under the management of Charles H. Tenney & Company showed a gain of 23 per cent in energy output for the last reported week as compared with a year ago, only one company showing a reduction in output. The Montpelier & Barre (Vt.) Light & Power Company headed the list with a gain of 121 per cent, the second company being the Bristol & Plainville (Conn.) Electric Company, with a gain of 41 per cent. Appliance sales are very active in the Tenney companies at present, the total to May 20 this year in ten companies, electric and combination, being $219,785. For the first quarter of 1923 the total appliance sales in ten of these companies was $120,991 against a quota of $104,674. Cyrus Barnes, general sales manager of the Tenney organization, states that merchandising in these companies this year is being conducted with a quota of one million dollars total sales, the slogan being "A Million or More Before '24."

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Preparation, Transportation and Combustion of Powdered Coal.—JOHN BLIZARD.—A 127-page account on the many methods, advantages and disadvantages of preparing and burning powdered coal. Manufacturers and operators of coal-fired furnaces cannot afford to disregard the possible advantages of pulverizing their coal before burning it. Hence the purpose of this bulletin is to give statistics that will aid manufacturers and operators in making the proper estimates, enabling them either to abandon their present methods of burning coal on grates or stokers and to install the pulverizers, conveying system, powdered-coal feeders and burners best suited for burning powdered coal in their plant, or to reject as uneconomical the replacement of their present system by the system described. The following are some of the conclusions reached by the author: Powdered coal has proved an economical fuel for steam raising, cement making, metallurgical furnaces and many other purposes. For steam raising, with a properly constructed boiler and furnace, a continuous efficiency of over 80 per cent may be maintained. For other purposes a high temperature with no regenerators may be maintained by using powdered coal, with less coal consumption then when using producer gas, stokers or hand firing. The unit system alone is economically applicable for small installations where less than 10 tons a day is used. For larger installations the multiple system, with Raymond or Fuller mills and with indirectly fired driers, seems to be preferable. To distribute the coal, screw conveyors are recommended to convey large quantities of coal short distances and either the Fuller-Kinyon pump or compressed air to convey it long distances. The Quigley weighing tank is a valuable adjunct to the compressed-air distribution. The direct low-pressure system of distribution should be used solely to distribute coal short distances to small furnaces, where the cost and inconvenience of using separate bins and feeders for each furnace is unwarranted.—*Bulletin* 217 *of the Bureau of Mines.*

The Benson Superpressure Plant.—P. W. SWAIN.—There is nearing completion at Rugby, England, a plant designed for a minimum boiler pressure of 3,200 lb. The most interesting feature of this plant from the scientific point of view is the generation of steam without ebullition, by operating the steam generator in what may be called the "superpressure" region, that is, the region above the critical point. The claims made for this plant are a large saving in fuel cost, reduction in initial cost and a substantial saving in floor space.—*Power*, May 22, 1923.

Generation, Control, Switching and Protection

Constant-Potential Dynamo. — H. CHARLET.—A type of direct-current generator is described for train and automobile illumination, which is suitable for isolated hydro-electric and wind-driven plants and similar outfits where the automatic maintenance of a constant potential is necessary at variable speed of the prime mover. This machine utilizes a magnetic cross-field similar to the Rosenberg dynamo. The brushes of the neutral zone are, however, not directly short-circuited but deliver current through a tertiary winding around the stator poles. By proper connections of the two series windings the machine can be used advantageously as a starting motor of the automobile engine, and it fulfills in this case the double purpose of starter and generator. On a number of diagrams the electrical characteristics of this new dynamo are shown for different connections and purposes.—*Elektrotechnische Zeitschrift*, May 17, 1923.

Steam-Turbine Governors and Valve Gears Adjusting Speed and Speed Regulation.—E. H. THOMPSON.—The no-load speed of a turbine depends primarily on the tension or compression of the main governor spring. Increasing the spring resistance to the centrifugal pull of the moving weights or flyballs will ordinarily raise the no-load operating speed. Governor speed regulation, which is the relation between speed and the load in the unit, can be adjusted by one or more of the three general methods. Changing the speed adjustment will affect regulation to some extent and vice versa, while auxiliary devices present other complications.—*Power*, May 22, 1923.

Transmission, Substations and Distribution

Parallel Operation of Glass-Bulb Mercury-Arc Rectifiers. — A. ROTHENBERGER. — For direct-current variable-load supplies a considerable saving may be realized by installing, instead of one large metal-vessel mercury-arc rectifier, several small glass-bulb units, any number of which may be connected in parallel, conforming to the existing load demand. The author describes an automatic and a manual system for such operation. For both of these an electromagnetic tilting cradle is provided for each bulb. In the bus circuit of the automatic apparatus is a current relay with an adjustable time-lag element which adds each rectifier as it is demanded and disconnects them when the load falls off. Provision is made to cut out all bulbs if the supply should fail and to start them again with returning current. The hesitating relay is usually set to eight or ten seconds. The first bulb, which has to stay on the line at all times, has to be started by hand or by remote control. The non-automatic system is simply a contactor-operated remote control with push-buttons. — *Siemens Zeitschrift*, May, 1923.

33,000-*Volt Interconnector Cable.* — A complete description is given of the equipment of a 33,000-volt underground cable installed in England. The various tests made on the cable before installing, tests of joints, protection systems, etc., are considered.—*Electrical Review, (London)*, May, 1923.

Units, Measurements and Instruments

Resistivity of Aluminum of Different Temperatures.—G. GRASSI.—Very little is known about the resistivity of aluminum on account of the great difficulty of getting this metal pure. This paper, presented before the Royal Academy of Sciences in Turin, gives a report of the experiments and studies the author made on many samples of aluminum 97.6, 98.3 and at 99.7 per cent pure. The proceedings are clearly explained and illustrated, and practical formulas are given to determine the resistivity of any commercial grade of aluminum and its variations at different temperatures. — *Elettrotecnica*, April 15, 1923.

Electric Carbon-Monoxide Meter.—M. MOELLER.—To obtain a perfect control of the operation of a boiler plant, the constant observation of both carbon-dioxide and carbon-monoxide are essential. For measuring both of these gases electric indicators can be used based upon the different heat conductivity of the gases as compared with air. Two short platinum wires are each inclosed within a tube, through one of which passes air and through the other the gas to be volumetrically measured. The wires are electrically heated and change their ohmic resistance according to the amount of CO_2 or CO which passes through the respective tubes. Connecting the air wire and the gas wire into a Wheatstone bridge, a millivoltmeter in the bridge can be directly calibrated in per cent of CO_2 or CO. Both instruments are installed side by side near the boiler, and the gases are forced through their gas tubes by a partial vacuum created by a small water-jet pump. Any number of indicating or recording instruments may be remotely connected to these two sending apparatus. It is claimed that these instruments give far more accurate indications of the amount of these gases in the flues than any chemically operating types. — *Siemens Zeitschrift*, May, 1923.

Design of Current Transformers.—G. L. E. METZ.—In designing a new transformer the first of the type built must be carefully examined and checked to obtain information that will lay the foundation for future design. The author takes up briefly the theoretical design of transformers. While the electrical side of current transformer design is of primary importance, the mechanical aspect, he points out, must also receive careful attention.—*Electrical Review (London)*, May 26, 1923.

Illumination

Specifications for Large Tungsten-Filament Incandescent Electric Lamps.—This circular gives the specifications that have been officially adopted by the federal Specifications Board for the use of the departments and independent establishments of the government in the purchase of incandescent electric lamps. It includes general specifications, test specifications, tables of tolerances and comparison data.—*Circular No. 13 of the Bureau of Standards.*

Daylight Illumination on Horizontal, Vertical and Sloping Surfaces.—H. H. KIMBALL.—The report summarizes sky-brightness and daylight-illumination measurements made during the year ended April 6, 1922. For ten months the measurements were made in a suburb of Washington that is comparatively free from city smoke. During the other two months, one in summer and the other in winter, the measurements were made in the smoky atmosphere of Chicago. This paper was presented at the Swampscott convention last fall, but has been revised and extended.—*Transactions of the I. E. S.*, May, 1923.

Motors and Control

Resynchronizing Characteristics of Synchronous Motors.—O. E. SHIRLEY.—The resynchronizing of synchronous motors under heavy load is a new engineering accomplishment. Successful results were obtained only by redesigning certain features of the motor and by originating several new auxiliary devices. The author discusses factors for successful operation, torque characteristics and tests under operating conditions. He then shows the results of interruption in power supply and concludes his article with some remarks on general operating characteristics.—*General Electric Review*, June, 1923.

Electrification in the Pulp and Paper Industry.—H. W. ROGERS.—At present the total primary power in this industry is approximately 2,250,000 hp., of which somewhat over 600,000 hp. represents electric power. Consequently there is some 1,650,000 hp. still unelectrified. The author points out how electricity is the only practical power-distributing agent that permits of centralized power-generating apparatus and at the same time affords a flexibility in transmission which allows a mill to be designed entirely with a view to its manufacturing efficiency. This industry also lends itself to individual machine drive by direct application, with its attendant economy in power consumption, maintenance and space. The author discusses the various types of machines used, individual drive, variable-speed mechanisms, importance of process steam and various systems of electrification applicable to paper mills. The accompanying table gives an approximate power requirement for a 100-ton mill.—*N. E. L. A. Bulletin*, June, 1923.

APPROXIMATE POWER REQUIREMENTS FOR A 100-TON MILL (80 per Cent Ground Wood and 20 per Cent Sulphite)

	Hp.
Yard conveyors	128
Wood preparation	190
Ground-wood mill:	
Grinders	4,650
Pumps, screens, conveyors	450
Sulphite mill:	
Chippers	112
Digester and acid	61
Screens	435
Pumping	290
Machine room:	
Paper machines, beaters, agitators, fans, air compressors	1,628
Machine shop	34
Miscellaneous	50
Total	8,028
Boiler hp. for heating, drying, cooking, etc.	1,100

Heat Applications and Material Handling

Problems of Selecting Type of Motor Drive for Large Mine Hoisting Plants.—G. BRIGHT.—Developing mines for a large output means high rope speeds and large hoisting loads, or both. These two factors introduce many important problems, among them being the proper selection of the type of drive, exacting precautions to provide continuity of operation and low cost of upkeep. The author discusses these factors, pointing out the limitations of the various types of drive. Some interesting graphs are given showing the hoisting cycle with forced and naturally ventilated motors and a comparison of the alternating-current and direct-current motor-hoisting cycle.—*Coal Age*, June 7, 1923.

Traction

Truck-Overhauling Methods.—The several practices commonly used in overhauling trucks are described, the account being based on a survey covering fifty electric railway shops. The best methods to be followed and the most effective equipment to be used are discussed. An overhead crane provides the most efficient means of handling materials.—*Electric Railway Journal*, May 19, 1923.

The Buenos Ayres Western Railway.—The electrification of its suburban lines by this company includes a power station of 25,000 kw. capacity, 72.5 miles of high-pressure cables, four traction substations with 15,000 kw. of converting plant and the electrical equipment of 70 miles of single track. In addition, the supply of power and lighting calls for transforming plants to the extent of 7,000 kw. distributed in four static substations and two traction substations. A very complete description is given of the generating station, substations, transmission systems, electrical equipment of track and rolling stock.—*Electrical Review (London)*, May 18 and 25, 1923.

Telegraphy, Telephony, Radio and Signals

French High-Frequency Generators.—H. EALES.—Four standard sizes of motor-generators for radio service are described, ranging from 25 kw. to 500 kw. output and designed for 32,400 cycles to 15,000 cycles alternating current. The peripheral speed of the rotors is 150 m. per second, which is considerably less than in modern steam-turbine practice. The laminations vary in thickness from 0.5 mm. to 0.9 mm., according to frequency, and are insulated from each other by enameling. The largest two types are totally inclosed and their rotors run in a partial vacuum (200 mm. mercury column). The smallest type has a water-cooled stator; the others are oil-cooled.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie*, April, 1923.

Power Company Communication Developments.—In the annual report of the sub-committee on communications of the Pacific Coast Electrical Association three types of communication used by Western power companies have been studied. Troubles on wire communication lines are discussed as well as the developments of space radio and carrier-current radio for power-company use—*Journal of Electricity and Western Industry*, May 15, 1923.

Alternating-Current Resistance and Inductance of Single-Layer Coils.—C. N. HICKMAN.—An integral-equation method is used to develop formulas for the alternating-current resistance and inductance of a system of parallel "go and return" circuits. It is shown how these formulas may be applied to single-layer coils. The formulas are applied to several coils in which the skin effect is quite pronounced. These coils are measured at several frequencies and the results compared with the computed values. The methods of measurements are explained and a discussion pertaining to the distribution to the effective resistance in a coil is included. The eddy-current losses due to dead ends are measured and discussed. A simple formula for the mutual inductance between coaxial circles of the same diameter is also developed.—*Scientific Paper No. 472 of the Bureau of Standards.*

Automatic Telephones in the Power Station.—A short description is given of the automatic telephone system installed in the Glasgow Corporation Electricity Department. The apparatus has a capacity of 200 lines. An outstanding feature in connection with this board is that, being power-driven and its action being very positive, all the switching and connecting apparatus can be made more robust and therefore better able to stand the wear and tear of prolonged use.—*Electrical Times (London)*, May 24, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Why Davis Was Ousted

Politics and Water Users, Not Power Companies, Caused Reclamation Chief's Resignation

INQUIRY made at Washington by the ELECTRICAL WORLD has failed to discover any foundation for the press reports that Western water-power companies were largely responsible for the forced resignation of A. P. Davis, former director of the Reclamation Service, whom Secretary of the Interior Work replaced by former Governor D. W. Davis of Idaho. The change in control is declared by those in a position to know to be unquestionably the result of pressure from water users and of a desire to use the Reclamation Service in politics.

In defense of his removal of A. P. Davis from the post he had filled so long and in answer to protests emanating from the Federated American Engineering Societies and other sources Mr. Work said: "We don't need two engineers in charge of the Reclamation Service. In the future the service head will be known as the chief of the Bureau of Reclamation and will be qualified first to aid the farmers rather than supervise engineering works on the projects. D. W. Davis, former Governor of Idaho, is such a man and I have appointed him as the bureau chief, have abolished the office of director and placed F. F. Weymouth, former assistant chief of the service, in the position of chief engineer of the bureau." Mr. Weymouth has been stationed at Denver.

PROTEST OF THE F. A. E. S.

In explanation of the stand of the Federated American Engineering Societies, Secretary L. W. Wallace issued a statement saying in part:

"The displacement of the director of the Reclamation Service and the appointment in his stead of a man who apparently is not technically trained and fitted to direct an important technical service of the government is looked upon with grave concern by the engineers and technical men of the United States, because such summary action will undermine the morale of all the technical agencies of the government.

"The work of the Reclamation Service is essentially of an engineering and technical nature. There are business aspects to be true, but so far as is known there has been no criticism of the business direction of the service, other than perhaps by certain interests in the West that have endeavored to secure a reduction in or have endeavored to repudiate payments for reclaimed lands purchased."

Northwest Association Listens to Outsiders' Viewpoint

Public relations and the attitude of the public toward the utilities were among the chief topics discussed at the sessions of the Northwest Electric Light and Power Association convention, which was held at Seattle last week with a registration of more than 250. The program this year was unusual in that a number of speakers from outside the industry were invited to discuss the problems of the utilities as they are viewed by those unconnected with them. A report of their remarks and of other convention proceedings will appear in an early issue of the ELECTRICAL WORLD.

A. M. E. S. Elect Officers

At the closing session of the summer convention at New London, too late for inclusion in the report last week, the Associated Manufacturers of Electrical Supplies devoted the afternoon to routine business, principally the reports of committees and the election of officers. The ways and means committee, W. W. Nichols chairman, recommended that the A. M. E. S. become a sustaining member of the American Engineering Standards Committee, but action was deferred. F. L. Bishop, Hartford, Conn., was elected vice-president of the association, and the following were made members of the board of governors: M. C. Rypinski, Sears B. Condit, W. W. Mumma, A. G. Kimble and F. T. Wheeler. The other officers continued.

Illuminating Engineering Society Elects Officers

National officers of the council of the Illuminating Engineering Society have been elected for the fiscal year 1923-1924 as follows: President, Clarence L. Law; general secretary, Samuel G. Hibben; treasurer, L. B. Marks; vice-president, D. McFarlan Moore; directors, James P. Hanlan, Howard Lyon and H. F. Wallace. Section chairmen and secretaries will be: New York, L. J. Lewinson and J. E. Buckley; New England, W. V. Batson and Julius Daniels; Philadelphia, H. Calvert and J. J. Reilly; Chicago, F. A. Rogers and E. J. Teberg.

N. F. P. A. Hearings

New Under-Floor Duct System and New Electric Wiring System to Be Submitted July 17

THE committee on new developments of the electrical committee of the National Fire Protection Association announces through Chairman Dana Pierce that on July 17 it will hold a public hearing on a new under-floor duct system, using a special form of fiber duct with suitable junction boxes and other fittings, submitted to the committee for approval by the Johns-Manville Company of New York. This system is proposed for use embedded in concrete floors of fireproof buildings. Its purpose is to provide a flexible system of wire distribution for electric lights and other devices connected to building electric service, and also for the distribution of communication wires for telephones, call systems and the like.

Two types of systems are under consideration. One of these is a double-duct system in which entirely separate duct systems are laid in the floors, one to contain electric light wires and the other to contain communication wires. In this case it is proposed to use in the electric light ducts ordinary rubber-covered wire for the circuits. In the second, or single-duct, system it is proposed that the electric light wires be run in standard grounded armored cable on the loop system, in which case the communication wires will occupy the same ducts with such cable.

Both systems provide junction boxes or manholes, from which all fishing operations are conducted, and in both systems it is possible at any time to establish new floor outlets by cutting through the concrete above the duct and installing a special threaded insert. In both systems the circuits within the box are supplied by feeders run from a center of distribution in steel conduit to a junction box of the under-floor system. In its present forms this system is proposed for use only for branch circuits, that is, circuits which may properly be protected under the new code rules by 15-amp. fuses.

NEW ELECTRIC WIRING DEVICE

The hearing will take place in the assembly room of the New York Board of Fire Underwriters, 123 William Street, New York City, at 10:30 a.m. (daylight-saving time), and all persons having an interest in this question are invited to present their views to the committee in the form of briefs, which may be filed at the time of the hearing or immediately thereafter. At 2 p.m. on the

same day (July 17) the committee will hold a similar hearing on a new form of two-conductor material for general wiring consisting of rubber-covered wires with special non-metallic protective coverings. This is intended for wiring circuits in both open and concealed work without insulating supports and without metal armor, conduit or flexible tubing, the protection of the conductors and their insulation being furnished by the coverings on the conductors themselves. The coverings consist of rubber, windings of paper and cotton braids with fire-resisting and moisture-proof impregnations. This hearing concerns "Romex," a new electric wiring material submitted by the Rome (N. Y.) Wire Company.

John A. Britton Dies Suddenly

Vice-President of Pacific Gas & Electric Company Had Just Returned Home from N. E. L. A. Convention—Pioneer in Western Hydro Field—His Engaging Qualities

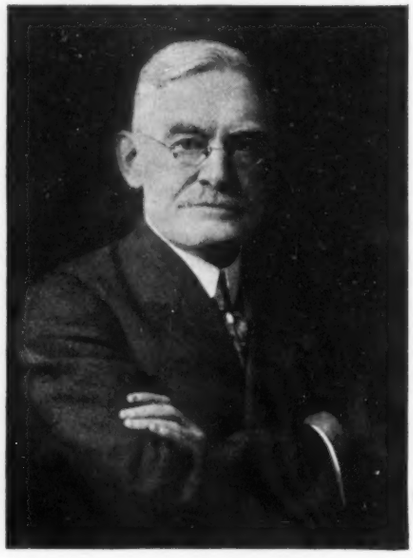
JOHN ALEXANDER BRITTON, first vice-president and general manager of the Pacific Gas & Electric Company, known in the West as the "Dean of the Electrical Industry," and with many friends in all parts of the country who were attracted to him by his genial nature and lovable attributes, died in San Francisco on Friday, June 29, after a short illness caused by ptomaine poisoning, at the age of sixty-eight.

Mr. Britton attended the convention of the National Electric Light Association in New York in early June and was then in his usual health. He took an active part in the proceedings, making two speeches of considerable length in the ready and forceful manner that always roused his hearers to applause. One of these speeches was on water power. The other was on another of his favorite topics—customer ownership. In it he related the early history of this movement, of which he was the father, telling of its success in the territory of his company and of the part it played in defeating the proposed constitutional amendment for state ownership and operation of water-power developments in California. So effectively did he speak that his hearers were aroused to great enthusiasm, and when he ceased an ovation that lasted several minutes was given to him.

At this convention Mr. Britton was elected first vice-president of the association in succession to Walter H. Johnson, the new president. This election would, in the usual course of events, have brought the presidency of the N. E. L. A. to Mr. Britton next year.

NOT A "NATIVE SON"

Though no man was more closely allied with Pacific Coast growth or more imbued with the progressive Western spirit that John A. Britton, his birthplace was in Roxbury, Mass. (now a part of Boston), in 1855, and he was thirteen years old when he removed to San Francisco. A year later he left school and went to work in a grocery store, toiling sixteen hours a day and longer on Saturdays. In six months he became a bookkeeper in a musical institute, where his meager salary of $6 a week was in part compensated by the opportunity to pursue the musical studies in which he always delighted. Another year saw him a



JOHN A. BRITTON

clerk in a lawyer's office, and a lawyer he would almost surely have become had not incessant work and study undermined his health and forced him, three years later, as a temporary expedient, to seek out-of-doors employment. He procured a place as a collector with the Oakland Gas Company, and his life work began. This was in 1874, when Britton was still under twenty.

GAS, THEN ELECTRICITY

He mastered various phases of the gas business, rising to be secretary of the company about 1879, and decided to abandon the law for engineering. The first electric arc-lighting plant on the Pacific Coast was erected at San Francisco in 1880, and young Britton was in at the birth. The Oakland Gas Company made its first electric installation in January, 1885. "I bought every book I could buy on electricity," he said many years later, "and studied every phenomenon I could hear of. I attended night school for electrical engineering. As we installed machinery in Oakland I knew exactly what it was, what its functions were, so I could take it apart and put it together. I designed and built the first electrical plant in Oakland. All the improvements and extensions of the company's properties from 1897 were designed and built under my direction."

In 1895 he became chief engineer of the Oakland company, and in 1898 he was elected president. When the company was merged into the California Gas & Electric Corporation Mr. Britton occupied the new presidential chair, and in 1905 the process was repeated when the smaller companies became subsidiaries of the new Pacific Gas & Electric Company. Three years later, however, his title was changed to the one he bore at the time of his death—vice-president and general manager—a position which kept him in closer personal touch with the everyday activities of the organization. One of the secrets of his popularity as an executive head was his policy of "the open door." He was accessible not only to visitors but to employees.

NEARLY FIFTY YEARS' SERVICE

Next year would have been the fiftieth anniversary of Mr. Britton's connection with the erstwhile Oakland Gas Company. His was the longest record in the service. During that half century the electrical industry on the Pacific Coast grew from nothing to its present vast proportions, and he might have said with Virgil: "All of these things I saw, and a great part of them I was." He was identified with public utility work long before the first hydraulic station in California was placed in operation and sixteen years before the famous single-phase transmission line at Telluride was completed in 1890. His life was part and parcel of the story of how water power was harnessed and high-tension lines were built and interlaced on the Pacific Coast. For the Pacific Gas & Electric Company, which now, with 650,000 customers, serves eighty-nine incorporated cities, 142 villages and towns and a suburban area of 35,000 square miles, with twenty-eight hydro-electric and four steam plants, he had charge of all construction work, and he was responsible for the operating and financial policies of the company in all its departments.

His work as an executive engineer, however, was by no means the sum total of his achievements. As member and chairman of the public policy committee of the N. E. L. A. he did a most important task extremely well. His furtherance of the sale of company securities to customers has already been alluded to. The California Electrical Co-operative Campaign owes much to his foresight and initiative. He was a member of the board of regents of the University of California, a prominent director of the Panama-Pacific International Exposition, and to him was accorded by common consent a conspicuous place among the "builders of the West."

HIS WINNING CHARACTER

Courage, energy and ability to estimate accurately future possibilities Mr. Britton had in abundant measure. With these qualities and with his natural ability as an engineer and executive and his tireless industry he joined characteristics of humanity and

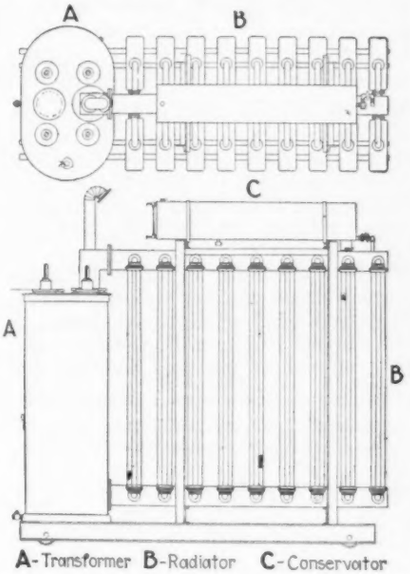
native kindliness that made him sincerely esteemed by even casual associates and beloved by those who came into intimate contact with him. To these characteristics, to his readiness to regard the rights of others and extend help to them, has been ascribed the unrivaled esprit de corps displayed by the Pacific Gas & Electric Company under his management. His ability as a speaker was always at the service of the causes in which he believed, his love of music found expression in promoting musical enterprises in his home city, and his public spirit was exemplified in his work as chairman of the San Francisco chapter of the Red Cross and as chairman of the district Liberty Loan publicity committee during the war. He was a member of the American Society of Mechanical Engineers and the American Society of Civil Engineers as well as of the American Institute of Electrical Engineers, and he belonged to a number of social clubs and benevolent societies. He had been president of the Bohemian Club, which was devoted largely to the promotion of music and drama in San Francisco. He leaves a wife, who was Miss Florence Eastman, and three children.

Wigginton E. Creed, president of the Pacific Gas & Electric Company, and several of the officials and employees of the company, as well as other citizens, paid tribute to Mr. Britton's memory in the San Francisco press. The funeral services were held on Monday last under Masonic auspices.

Recent Notable Transformers of General Electric Make

A notable example of large single-phase self-cooled transformers is furnished by seven 60-cycle, 10,417-kva. auto-transformers which will soon be put in service by the Brooklyn Edison Company. These transformers, now being completed in the Pittsfield works of the General Electric Company, will step up the generator voltage from 13,800 to 27,600. They will have a transformer rating of 10,417 kva., but since they are auto-transformers of a one to two ratio, each will transform a total of 20,834 kva., so that the total output of a bank of three transformers will be 62,502 kva. This is probably the largest amount of energy transformed by any single bank of self-cooled transformers. A novel feature of the design is the arrangement of the radiators. They are arranged in a double bank mounted on two large manifolds connected to the top and bottom of the transformer tank proper. The whole structure will be mounted upon a truck to permit the complete transformer to be run into its cell. A door or baffle will be built in between the transformer tank and the bank of radiators so that the transformer in its cell will be completely separated from its bank of radiators. This construction, which was dictated largely by space limitations, may find many applications.

The General Electric Company has also just completed at its Pittsfield works, for the Kansas City Gas & Electric Company, two three-phase 60-cycle, 15,000-kva. self-cooled transformers provided with three windings for simultaneous operation. Each transformer will be capable of delivering the full capacity of the transformer. These transformers are noteworthy not only on account of their large kva. rating, but also on account of the high voltage and other complications entering into the design. The high-voltage windings were designed for 132,000 volts, Y-connected, and are provided with full-capacity taps down to 120,000 volts. The intermediate voltage winding was designed for 72,000 volts, Y-connected, and is provided with full-capacity taps down to 60,000 volts. The low-voltage winding was designed for 12,470 volts without taps. The transformers may be operated from either of the high-voltage windings at full kva. capacity to the low-voltage winding as straight transformers in either case. They also may be operated as auto-transformers from 13,000 volts to 72,000 volts and at the same time deliver load at 12,470 volts. The multiple-circuit windings with solidly grounded neutral developed, which were first used by the General Electric Company for the 220,000-volt transformers on the Pacific Coast, are employed for the high-voltage windings of the Kansas City transformers. Interleaved disk coils are used for the high-voltage auto-transformer windings, and "helical" coils for the low-voltage winding.



RADIATOR DESIGN FEATURE OF G. E. SELF-COOLED TRANSFORMERS

Niagara, Lockport & Ontario Expansion

Petition has been made to the New York Public Service Commission by the Niagara, Lockport & Ontario Power Company for permission to acquire all capital stock of the Lower Niagara River Power & Water Supply Company and to purchase land in Niagara Falls and Lewiston held by the North End Land Company of New York City.

The purchase price for the property is set at $500,000 and includes 1,259 shares of stock and 916 acres of land. The stock now is held in trust for the benefit of the power company, which thinks the time has come for an expansion of its service. The development contemplated involves the transmission of energy to sixteen counties in western New York. Cheektowaga, Lackawanna and other places near to Buffalo will get energy from the development, and a certain amount, it was said by counsel for the company, will probably be sold to the General Electric Company of Buffalo.

Advertise More, Sloan Tells Empire State Men

Central-station companies should spend at least 1 per cent of their gross income for advertising if they expect to build up and hold the good will and confidence of the public, declared M. S. Sloan, president of the Brooklyn Edison Company, before the Commercial Section meeting of the Empire State Gas and Electric Association held at Briarcliff Manor, N. Y., June 28 and 29. He deplored the fact that few companies are now spending even as much as one-half of 1 per cent of their gross revenue on newspaper publicity. "It is up to the commercial men," said Mr. Sloan, "to wake up and make their executives spend more money for advertising. It is as much the duty of the sales departments to sell the industry to the public as it is to sell gas and electric appliances to the individual customer. Only when the people know the story of the industry and the truth about water-power development can the central-station feel safe from municipal or state ownership."

A most comprehensive report and plan for the development of rural service lines was presented by Bert H. Shepard, chairman of the rural lines committee. Mr. Shepard stated that the association's work along this line had progressed to a point where it expected to meet with the Public Service Commission in the near future to formulate definite rules and regulations to govern rural-line practice in New York State.

Speaking on the service of the utility company from the viewpoint of an outsider, H. W. Bell of the Utica Savings Bank described the central station as the modern purveyor of fire, which, since the dawn of history, has been the chief factor in the advancement of civilization. He urged central-station men not to neglect their opportunity to keep constantly before the public the importance of the service which they furnish.

At the close of the meeting H. A. Doering was unanimously re-elected to

serve his third term as chairman of the Commercial Section and W. J. Reagan was unanimously elected vice-chairman.

A. S. T. M. Considers Electric Specifications and Tests

Specifications for condenser tubes, standardization of tests and test procedure for electrical insulating materials, and characteristics and insulation tests of electrical slate were among the subjects of interest to electrical engineers discussed at the twenty-sixth annual meeting of the American Society for Testing Materials, at Atlantic City June 25 to 29.

The report of the committee on electrical insulating materials was accepted with all recommendations. This report covers dielectric strength tests for cambric tape, sludging tests for transformer oils, the effect of rate of raising potential in dielectric strength tests of sheet materials and a method of test for power factor and dielectric constant of insulating materials at commercial frequencies. Tentative standards for test of electrical insulating materials for voltage effects at radio frequencies and a method of testing cable splicing and pothead compounds were also passed. Several sections were added to the tentative methods of testing insulating varnishes, covering a draining test, an evaporation test and a test for non-volatile matter.

A general discussion of the characteristics, tests and application of slate for electrical uses was held by both producers and users. Oliver Bowles presented a paper a part of which was devoted to desirable standards and tests of electrical slates. Dean Harvey and J. J. Keyes reviewed the more important application of slate for use in electrical apparatus, set forth the requirements of good slate and gave the characteristics of typical slate. They also discussed the various tests for electrical slate. R. M. Spurck described the early methods of testing the insulation of electrical slate and discussed the development, characteristics of and the results obtained by a new method of making insulation tests.

The committee on rubber products presented tentative specifications for rubber matting for use around electrical apparatus on circuits not exceeding 3,000 volts to ground. These specifications were accepted and covered the manufacture, mechanical and electrical tests, dimensions, inspection and rejection of mats. The tentative specifications for rubber gloves were advanced to standard specifications.

The method submitted by the committee on magnetic properties for testing the magnetic properties of iron and steel permits the use of any method which yields result within the specified limits of accuracy. Reference methods were specified by which the accuracy of permeameters can be determined.

June Financing Shared by 27 Utilities

NEW electric light and power public utility offerings of stocks, bonds and notes during the month of June amounted to $54,471,450, comparing with $52,026,000 during the preceding month. The bringing out of a large number of small issues was responsible for the total reached, for the largest single offering was the $4,500,000 issue of first mortgage bonds of the Northern Canada Power Company, Ltd., offered at 99½ and yielding 6.56 per cent. Fourteen of the remaining twenty-six offerings were less than $2,000,000. The rate of return yielded the investor, which had advanced consistently from 6.08 in January to 6.47 in May, dropped to 6.30 during the month of June. Although seven of the issues were offered in whole or in part for refunding purposes, most of the offerings represent applications for new capital. The financing was substantially of a long-term nature.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JUNE

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Wisconsin Power, Light & Heat Co...	$350,000	3	Collateral gold notes, series A.....	Refunding and other corporate purposes	6½	99½	6.75
Potomac Edison Co. (Md.).....	3,900,000	25	First mortgage gold bonds, series A....	Refunding and additions.....	6½	97	6.75
Dubuque Electric Co. (Ia.).....	3,000,000	19	First mortgage gold bonds.....	Refunding and other corporate purposes	6	98½	6.15
Central States Electric Corp. (Va.)...	4,000,000	2	Secured gold notes (with stock purchase warrants).....	To increase working capital.....	7	100	7
Niagara, Lockport & Ontario Power Co. (N. Y.).....	3,000,000	3	Convertible gold notes.....	Additions and improvements.....	6	100	6
Oklahoma Gas & Electric Co.....	1,000,000	18	First and refunding mortgage gold bonds, series B.....	To pay floating debt.....	6	94½	6.50
Western States Gas & Electric Co. (Cal.).....	2,000,000	24	First and unified mortgage gold bonds, series A.....	Additions.....	6	96	6.30
Consolidated Power & Light Co. (W. Va.).....	1,500,000	..	Cumulative preferred stock.....	Additions.....	7	93½	7.50
Jersey Central Power & Light Corp...	1,156,250	..	Cumulative participating preferred stock.....	Additions and corporate purposes...	7	92½	7.57
Mountain States Power Co. (Ore.)...	3,100,000	15	First mortgage gold bonds, series B....	Refunding and to provide working capital.....	6	95½	6.50
New England Power Co. (Mass.)....	1,800,000	28	First mortgage sinking-fund gold bonds of 1911.....	Additions and extensions.....	5	97½	5.15
Northern New York Utilities Co....	2,212,200	20	First lien and refunding bonds, series C.	Additions.....	6	99	6.10
Southern Canada Power Co., Ltd. (Que.).....	1,500,000	..	Cumulative participating preferred stock.....	Additions.....	6	90	6.67
Carolina Power & Light Co. (N. C.)..	2,500,000	30	First and refunding mortgage gold bonds.....	Additions and corporate purposes...	6	97½	6.15
Jamaica Public Service Co., Ltd. (West Indies).....	1,000,000	20	First mortgage sinking-fund bonds, series A.....	Additions.....	6½	100	6.50
San Joaquin Light & Power Corp. (Cal.).....	2,500,000	29	Unifying and refunding mortgage gold bonds, series B, non-callable.....	Additions, and corporate purposes.....	6	99	6.05
Adirondack Power & Light Corp. (N. Y.).....	1,250,000	27	First and refunding mortgage gold bonds, series of 6's.....	Additions.....	6	99½	6.05
Binghamton Light, Heat & Power Co. (N. Y.).....	358,000	23	First refunding mortgage gold bonds of 1916.....	Additions.....	5	88	6
Memphis Power & Light Co. (Tenn.)	2,000,000	25	First and refunding mortgage gold bonds, series B.....	To reimburse for expenditures and for other corporate purposes.....	6	99½	6.05
Toledo Edison Co. (Ohio).....	1,050,000	24	First mortgage gold bonds.....	To reimburse for construction.....	5	91	5.70
Scioto Valley Railway & Power Co. (Ohio).....	1,400,000	20	First mortgage sinking-fund gold bonds	Refunding.....	6	97½	6.20
Consumers' Power Co. (Mich.).....	3,500,000	29	First lien and unifying mortgage gold bonds, series C.....	To reimburse for construction.....	5	89½	5.75
Electric Bond & Share Co. (N. Y.)...	2,750,000	..	Cumulative preferred stock.....	General corporate purposes.....	6	97½	6.15
New Bedford Gas & Edison Light Co. (Mass.).....	1,145,000	15	First mortgage gold bonds, series C....	Additions.....	5	100	5
Northern Canada Power Co., Ltd. (Ont.).....	4,500,000	15	First mortgage sinking-fund bonds.....	Refunding, additions, betterments...	6½	99½	6.56
Sierra & San Francisco Power Co. (Cal.).....	1,000,000	26	First mortgage gold bonds of 1909.....	To reimburse for construction.....	5	87	6
Savannah Electric & Power Co. (Ga.)	1,000,000	2	Gold notes.....	Additions.....	6½	99½	6.75
Total.....	$54,471,450						

Water Power in New York

State Authorities and Federal Power Board May Reach Understanding —St. Lawrence Suits

PROGRESS in overcoming the legal difficulties which have so far thwarted development of the state-owned water power of New York State has been made, according to Albany advices to the ELECTRICAL WORLD, as the result of the conferences between the State Attorney-General's office and the federal government. It has already been intimated in these columns (May 19, page 1162) that as a result of such conferences the pending litigation to determine the state's rights under the Esch law may possibly not be pushed by the New York officials. It is now asserted that Attorney-General Sherman will recommend to Governor Smith that the pending suit be withdrawn.

The federal government's disclaimer of any intention to exercise supervision over water-power development on canalized inland streams and its expressed willingness to co-operate with New York in statutory plans for the development of water power either by private lease or by the state itself are taken at Albany to mean that the United States government will not seek to establish the position of primary federal supremacy in regulation of the development of all water power, under the superpower development plan favored by Governor Pinchot of Pennsylvania, and that applications now pending with the New York State Water Power Commission may be approved and development maintained, or that the state itself may by appropriation of money or by bond issue undertake a comprehensive system of development of state-owned power.

This does not mean, however, that the state will abandon its suits pending against about eighty owners of mostly undeveloped private water-power rights and riparian rights in the St. Lawrence River watershed. These actions have been brought with the idea of securing to the state the sovereignty over all of the units of the St. Lawrence power essential to its successful development either by the state itself or through private capital. The history of these particular power and riparian rights dates back to 1826, and the state is seeking to determine through legal adjudication just what it owns within its boundaries and what it may use or lease. One course favored is a special act of the Legislature taking possession of the dam on the south channel of the St. Lawrence River and such power and riparian rights as are needed and allowing the various parties aggrieved to come into the court of claims for compensation.

The Ferris amendment to the New York State Constitution allowing the building of transmission lines and power stations on the lands of the forest preserve goes to the people for approval at the general election in November. So far the press has paid little attention to this important matter. Its failure of ratification will mean that the St. Lawrence power, if developed, cannot be economically transmitted to the capital district and New York City, because under the constitution as it now stands transmission lines cannot be built through the forest preserve in the Adirondacks.

The New York State Water Power Commission is preparing a report based on the negotiations had by the state agencies with the federal authorities which will very soon be submitted to Governor Smith. The report will outline suggestions for immediate steps to secure power development.

Iowa Men's Convention Is Comprenensive

Invulnerable Securities, Ranges and Merchandising, Plant Design, Transformer Maintenance, Valuation Bases and Rate of Return Are Discussed at Mason City

SECURITY of such order that bonds and preferred stock shall be absolutely protected, adequate reserves for maintenance and the keeping of speculation away from public utility issues were three essentials named by Frank T. Hulswit, president of the United Light & Railways Company, in discussing utility financing before the Iowa Section of the National Electric Light Association at Mason City last week. Mr. Hulswit analyzed the financing of a utility undertaking, pointing out the place of bonds, preferred stock and common stock in the financial structure. He criticised past practices which had led to attempts to finance largely by bond issues and said that unless the proper relation between the various classes of securities is maintained it is only a question of time until a weakened financial structure will give trouble. He said also that unless security of a high order is placed back of the issues the industry must eventually get into a predicament which will make the troubles of the past seem child's play and will in time bring municipal ownership.

The sale of "electric cookery" was suggested as a better term than the sale of the electric range by H. D. Mitchell of Cedar Rapids in discussing this appliance Mr. Mitchell declared that manufacturers of ranges must be progressive, must not quibble over backing up their product by the replacement of defective parts, and also that the range must be designed so as to be pleasing to the eye of the buyer. He advocated a thorough training of the utility forces in the handling, use and servicing of electric ranges before any campaign of sales is undertaken, so that the entire organization including office employees and linemen, shall be thoroughly "sold" on their use and able to back the campaign.

TRAINING THE HOUSEWIFE

Mr. Mitchell urged the need of training the housewife in the proper use of the electric range, advocating daily reading of the range meter for two or three weeks and every three days for a period thereafter to detect and correct tendencies toward inefficient use which will prove expensive. The subject was discussed by V. O. Stafford of Humboldt and J. F. Reach of the Edison Electric Appliance Company.

"GOOD-WILL" MERCHANDISING

Merchandising operations that are first self-sustaining and then builders of good will were advocated by H. L. Green of Waterloo, who took the stand that appliance salesmen must be taken out of the class designated as "door-bell pushers" and developed into employees who represent service ideals in their contact with customers. He urged a combined salary and commission basis that would attract men of the best type in this sales work.

In discussing the servicing of appliances C. A. Nash of Davenport said that repairs should be made first and the question of who sold the appliance and how payment for repairs should be rendered settled afterward, the object being to keep appliances in service. Speaking of advertising, Mr. Nash took the position that there should be less use of graphs, curves and mechanical data and a greater use of the human-interest appeal by telling what can be done with electrical energy and how its use makes for better living.

DISCUSSION OF HEAT BALANCE

Strong emphasis was placed on the consideration of heat balance by G. T. Shoemaker of the United Light & Railway Company in discussing "Modern Power-Plant Design" before the joint session with the Iowa Electric Railway Association on Thursday. Bleeding of steam from the main turbines to obtain steam for the auxiliaries and to help in maintaining the heat balance was advocated by the speaker, who said that among other advantages it would be possible to avoid the use of high-pressure piping for the auxiliaries if this method of insuring steam supply were taken. Preheating of the air both through heaters that take heat from the waste gases and by use of the warm air from the turbines for use in the furnaces was discussed. The difficulties due to extra-pressure drop in the waste gas heaters and the troubles involved in keeping the heaters clean were pointed out by Mr. Shoemaker, and the possible advantage of using steam bled from the turbines was discussed. He also pointed out the much better economies obtainable with

present turbine designs and suggested careful consideration of old plants equipped with older types, saying that in many cases even the smaller sizes of turbines could be economically replaced with new machines. A careful study of the fuel supply and a careful fitting of equipment to fuel was urged.

C. G. Johnson of the Union Utilities Company of Chicago, pointed to the tendency toward supplying large areas from plants located at convenient points and told the convention that it is necessary to consider carefully the problem of any new plant, especially in a small town, to avoid the possibility of its becoming obsolete long before it is worn out by the construction of more economical plants in the territory which would make it advantageous to purchase power.

TRANSFORMER MAINTENANCE

C. R. Stahl of Davenport described a method of transformer maintenance by which the losses of transformers in Davenport have been reduced to a negligible quantity, even though it has been the practice to operate the distribution transformers on the system at an overload during the annual peak averaging 114 per cent of the installed transformer capacity for the entire low-voltage distribution system. The fact that the maximum load comes in the fall and early winter months when temperatures are low is one of the reasons why this can be safely done. In addition to the usual records of the transformers, consisting of the history card and location records, an inspection schedule is maintained which calls for two inspections a year. The first is in the early spring and consists of a thorough going over of the transformers to see that fuses, fuse blocks, lightning arresters, grounds and oil are in good condition. At this time the oil is either filtered or replaced and all the items of equipment in each installation are put in good physical condition. The next inspection is during October, November and December, when load tests are made and the loading conditions adjusted as the tests show to be necessary. The first inspection under the present method revealed some startling load conditions on the distribution system.

ACCOUNTING DISCUSSED

C. J. Anderson of Chicago and George F. Meyers presented discussions of uniform accounting and customer accounting respectively. The discussion which followed developed into a question-and-answer cross-fire on the "bookkeeping without books" method first used in customer accounting at Baltimore which revealed a great deal of interest in the method and much satisfaction with its results.

John A. Reed of Cedar Rapids discussed the effect of the latest court decisions on fair values, depreciation and rate of return, taking the position that these decisions have not changed materially the basis on which valuations for rate-making purposes should be made. He cited decisions to show that no single basis has been fixed by the courts for such valuations, but that reproduction costs at current values, original costs and all the other bases must have consideration before a value can be fixed. Mr. Reed also discussed taxation matters as they affect Iowa utilities, urging the need of careful attention to assessments to see that the local bodies which have authority over all property except transmission lines do not discriminate against utilities and make assessments on a higher basis than those for other kinds of property. He asked for careful attention to the transmission-line assessments made by the state executive council for the same reason.

Rural lines and inductive interference came in for discussion at the convention, the work of the national committees being canvassed. G. E. Turner of Chicago, representing the stock casualty insurance companies, spoke on government control of insurance companies and on the advantages of co-operation.

The officers for the coming year will be: President, C. A. Sears, Keokuk; first vice-president, Don Sterns, Humboldt; second vice-president, J. A. Reed, Cedar Rapids; secretary-treasurer, M. G. Linn, Des Moines.

Lighting-Fixture Men Meet

Manufacturers Discuss Design Problems and Popular Education at Buffalo Gathering

ABOUT sixty representatives of fixture concerns were registered at the annual business convention of the National Council of Lighting Fixture Manufacturers, held at Buffalo on June 26-28.

Tuesday's session was given over to a discussion of design matters, under the direction of E. T. Caldwell of Edward F. Caldwell & Company. M. Luckiesh, director of applied science, Nela Park, Cleveland, made a plea for greater consideration of the illuminating features of fixtures and demonstrated the artistic effects and relief from glare which can be accomplished by modern glassware.

Wednesday was devoted to a discussion of plans for general publicity to popularize lighting fixtures and particularly the lighting industry's slogan, "Notice the lighting equipment." C. C. Parlin of the Curtis Publishing Company and R. B. Wagner of the International Displays Company were the speakers.

At the business session of Thursday morning Col. E. T. Miller of the United Typothetæ of America spoke on "Why Trade Associations Should Promote Cost Accounting."

President Biddle of the National Council of Lighting Fixture Manufacturers, in his official address, urged that all manufacturers of lighting equipment join with the membership of the council, rather than "ride without paying fare." The maximum dues of the organization, he pointed out, are hardly one-third of the salary of an office boy. So far $114,604 has been pledged to the campaign for popular publicity, but this burden has been borne by a relatively small fraction of the makers of fixtures, and President Biddle urged every manufacturer of fixtures or parts to join the movement. "Money spent competitively," he pointed out, "is spent largely in a fight for existing business, but money spent co-operatively will develop new business for all branches of an industry."

Central Diesel-Engine Plant for Rio Grande District

Although the Central Power & Light Company of St. Louis entered the Texas field only a few years ago, it has quickly, through its subsidiary, the Texas Central Power Company, acquired a number of important electric light and power street railway and ice-making utilities, and among the cities in which it operates are Laredo, Corpus Christi and Del Rio. It has devoted itself especially to the development of the fertile Lower Rio Grande Valley and has ice and electric plants at Mission, Mercedes, San Benito, McAllen and other places, as well as at Matamores, Mexico, just across the river from Brownsville. The Central Power & Light Company has now decided to build a large central station at the load center of this group and tie the cities together by 66,000-volt transmission lines, and to carry out this plan it has determined to install Diesel engines instead of steam turbines.

The first section of the plant will consist of two 1,125-b.hp. Diesel engines, each directly connected to a 750-kw. generator with directly connected exciter. The engines are being furnished by the Busch-Sulzer Brothers Diesel Engine Company, and the electrical equipment by the Westinghouse Electric & Manufacturing Company. As the plant is expanded much larger Diesel units will be installed.

This semi-arid country requires irrigation for about six months during the year. Most of the pumping plants are now steam-operated, at heavy expense. It is expected that electrical energy can be supplied to the irrigation companies at a rate sufficiently low to warrant displacing the steam pumping plants with motor-driven machines.

The diversity of load—ice making, irrigation, cotton ginning and electric lighting—will result in a comparatively high station load factor. It is expected that the Diesel plant will deliver 11 kw.-hr. at the switchboard per gallon of fuel oil consumed. The two Diesel units will be operated by an engineer and an oiler per shift.

The Central Power & Light Company has operated Diesel engines in a number of its Texas properties for several years, so that it has its own knowledge of Diesel costs. Prior to this purchase it owned and operated twelve Diesel engines, with a total rating of 5,295 hp.

Water Power on Boundaries

Temporary Niagara Agreement Desired While New Treaty Waits—Rio Grande Plans Blocked

WHILE the governments of Canada and of the United States are maneuvering so as to secure maximum advantage in any reallocation of the diversion from the Niagara River, the power interests are advocating a temporary agreement whereby each side may use water up to the installed capacity of existing plants pending the ratification of a new treaty. It is recognized that the making of a treaty under the existing conditions must be a long-drawn-out process. The situation both in western New York and in Ontario is such that there is an imminent need for more power. It is an established fact that the manufacturing growth of western New York must be curtailed within the next few months if additional power cannot be secured. The situation is almost as bad in Ontario.

An important influence on the whole situation will be exerted by the completion of the development of the Niagara Falls Power Company, which will leave an installed capacity of 115,000 hp. lying idle while water far in excess of scenic requirements is tumbling over the falls. This will come at a time when the industrial progress of a populous area will have been very noticeably curtailed. The situation will be accentuated in Canada when the three new units of the Ontario Hydro-Electric Power Commission are installed. It will require 6,000 cu.ft. per second more than is granted by the treaty to operate them.

Since the treaty may have to include such highly controversial matters as the drainage diversion at Chicago, the diversion at the Welland Canal and through the New York Barge Canal, it is apparent to those most directly concerned on each side of the river that a temporary agreement must be set up. The main thing making for delay is the determination of the United States government to secure a greater proportion of the diversion. Under the existing treaty Canada gets 36,000 cu.ft. per second, while the United States gets but 20,000 cu.ft. per second. Canada naturally is maneuvering to hold the advantage she now enjoys.

SITUATION ON RIO GRANDE

No development of hydro-electric power on the Rio Grande can be expected for some time to come. The Federal Power Commission has been compelled to reject a preliminary permit requested by R. W. Morrison of San Antonio in connection with his plans to utilize water power for public utility use in Laredo, Tex.

The proposal was referred to the International Boundary Commission, which has jurisdiction over boundary matters between the United States and Mexico. Gustavo P. Serrano, the consulting engineer for the Mexican section, reported adversely on the project on the ground that it would violate the existing treaty, which provides that the Rio Grande must be kept open for navigation. The State Department concurs in the opinion of the Mexican engineer. Since no amendment to the treaty can be undertaken when there is no recognition of the existing Mexican government, it would seem that an indefinite period must elapse before any power development can be undertaken on the Rio Grande.

Institute Seeks Solution of Utility Credit System

The Institute for Research in Land Economics and Public Utilities, whose headquarters are at the University of Wisconsin, announces in its first official publication, "Institute News," that it has undertaken a study of public utilities to ascertain if the cost of the service with which they provide the public cannot be reduced by a solution of their credit problem.

"This study is entered upon for the purpose of discovering what is wrong with a public utility relationship which makes it necessary that these essential industries pay from 1 to 2 per cent more for their cheapest money, and up to 4 per cent more for their dearest money, than is paid by public corporations," says the institute's publication. Regulation should aim to eliminate risk and uncertainty from the investment of capital in these industries so that the rate of return would be comparable with that received from loans to public corporations. "Great advances have been made on the part of the corporations themselves. Management is on a very high plane; owners are appreciative of their public obligations as never before, and great economies in the processes of production and distribution have been achieved.

"The major public utility problem today, however, consists in establishing such a relationship between the corporations and the regulating agencies as will eliminate the risk and uncertainty from these enterprises and thus reduce the cost of the service—not by penalization of one or another party to the bargain—but by eliminating the necessity for the payment of a high risk reward. That public utility securities are gaining in favor with the investing public and that the cost of money to public service companies is rapidly coming back to normal levels are indicated in a study of the relative borrowing power of public service corporations for the last twenty-five years made by Herbert B. Doran of the institute.

"Establishment of the facts with regard to the cost of money to public service corporations is a preliminary step to an intensive study by the institute of the credit problem of regulated industries. Having determined the facts, the investigation will take the form of a detailed analysis of all the factors which make for the high cost of capital in these essential industries. Solution of the credit problem of regulated business, it is believed, is the way to true economy and important reductions in the cost of service. Reduction in the cost of capital is one way of reducing costs which does not, on the one hand, demand sacrifice in the service rendered or, on the other hand, a reduction of the wages of labor, with its attendant possibilities of decreased efficiency or increased dissatisfaction."

Richard T. Ely, professor of economics, is director of the Institute for Research in Land Economics and Public Utilities.

Brief News Notes

Metropolitan Edison Acquires York Haven Company. — The Metropolitan Edison Company of Reading, Pa., has acquired the stock of the York Haven Water & Power Company formerly owned by the York Railways Company. With this purchase the Metropolitan Edison Company now owns practically all of the capital stock of the York Haven Water & Power Company.

Tampico Plant More than Doubled.—When the new electric power plant of the Tampico (Mexico) Electric Light & Power Company is finished, which will be about July 15, it will have a rating of 16,500 kw., as compared with 7,000 kw., the present capacity. It is stated that the power lines will be greatly extended and the service generally improved.

San Diego Company Buys Office Building.—The San Diego Consolidated Gas & Electric Company has been forced by expanding business to seek larger office quarters and has purchased an eight-story fireproof building in San Diego of steel and concrete construction which it is now occupying. The building, formerly known as the Timken Building, has been renamed the Electric Building.

Michigan Standards for Electrical Service.—The "Standards for Electrical Service," as embodied in Order No. 1692 of the Michigan Public Utilities Commission, effective July 1, 1923, have been printed by the commission. They embody rules for service entrances, meters and meter tests, transactions with consumers, operating standards, extension of lines and other matters and contain forms for records and reports. Manfred K. Toeppen is chief engineer.

Idaho Power Company Files New Rates.—The Idaho Power Company has filed a new schedule of rates with the Public Utilities Commission, to go into effect Oct. 1 and apply to all Idaho territory served by the company. These rates are based on a valuation of $16,769,328. Thirteen classes of service are recognized under the proposed schedule.

Residence lighting customers are to pay 10 cents per kilowatt-hour for the first 12 kw.-hr., grading off to 4 cents. The active-room principle is used in determining all residential rates. Two other classes of service are specially classified for residential customers, domestic heating and cooking service and general residence service.

An Oregon Development.—Engineers of the Pacific Power & Light Company are making surveys over a 10-mile area along the Deschutes River, Oregon, in the vicinity of Ketchum station, about 20 miles from the mouth, with a view to the ultimate construction of a hydro-electric power plant to cost between $2,000,000 and $3,000,000. E. V. Lorenz, who was chief engineer at Hood River during the construction of the great power plant there, is in charge of the engineering party along the Deschutes, where a permanent camp has been established. The same company filed on power rights at this point more than a year ago. The proposed plant will develop 40,000 hp.

Tri-State Utilities to Control Wapsie Valley Power.—The Tri-State Utilities Company of Minneapolis has purchased a controlling interest in the Wapsie Valley Power Company from F. C. Cross of Cedar Rapids, Iowa. The entire property of the company is valued at $2,000,000. The Wapsie Valley holdings started in 1910, when Mr. Cross constructed a dam across the Wapsipinicon River at Central City, constructed a power house and began furnishing light and power to the towns of northern Linn County. The business was expanded rapidly until today eighty-three towns in Linn, Delaware, Buchanan and Jones Counties are served.

Church Tablet Celebrates Radio.—An unusual kind of church tablet has recently been put in place on the outside wall of Calvary Church, Pittsburgh. It is of bronze, designed and built by James H. Matthews & Company, Pittsburgh, and represents an outline map of the United States bearing an impression of the church building in the proper geographical location, from which lightning flashes are radiating. The inscription says: "January 2, 1921, from Calvary Church, for the first time in history, a church service was broadcasted by radio wireless by the Westinghouse Electric & Manufacturing Company. This tablet was placed (1923) by the unseen congregation."

Annual Report of Engineering Foundation.—In its annual report, just made public by Chairman Charles F. Rand, the Engineering Foundation tells of numerous achievements in the past year made in association with the National Research Council and other agencies. Among these are a nation-wide campaign to check the ravages of the shipworm, an investigation of arch dams to solve problems centuries old and a project for the study of concrete arches in co-operation with the American Society of Civil Engineers. An annual loss of millions to American industry through fatigue of metals has been shown to exist, and paint-on-wood research is now under way. The Engineering Foundation has co-operated with the division of engineering of the National Research Council.

West Penn Power May Need $50,000,000 New Capital for Expansion.—A recapitalization plan has been issued by the West Penn Power Company to make possible the raising of a large amount of new capital to finance the expansion program of the company. The terms of the plan include the offering of new 7 per cent preferred stock to holders of the $8,500,000 of 6 per cent cumulative preferred. A total of $41,945,300 of the new 7 per cent cumulative preferred will be authorized. There will also be authorized 500,000 shares of common stock, which will be exchanged share for share for the outstanding common stock, amounting to $22,500,000. According to officials of the company, its rapid growth may necessitate as much as $50,000,000 increased capital in the next few years.

Bridge Building Not Allowed to Interfere with Utility Service.—The legal authorities of Wisconsin have informed the Highway Commission of that state that there is no way to enjoin the Wisconsin-Minnesota Light & Power Company from continuing the functions of the company's Wissota dam on the Chippewa River at Eau Claire, which the Highway Commission claims is interfering with the construction of a bridge over this river. The opinion says that "a public service corporation may not be enjoined from impounding water during the night and releasing it during the day in the necessary operation of a power plant on a stream, even though the resulting fluctuations in the height of water of the stream below the dam impede the work of construction of the public bridge across the stream, where the contract for the construction of the bridge was made with the conditions at the bridge site in the minds and contemplation of the parties to the contract."

Convention Delegates Travel 120,000 Passenger-Miles in Automobiles.—In providing transportation to the equivalent of more than 120,000 passenger-miles without mishap or delay the transportation committee of the National Electric Light Association accomplished a noteworthy piece of work during the recent convention in New York. More than two hundred vehicles were used. There were 7,500 convention delegates and something was on the committee's program for every morning, afternoon and evening. As entertainment features for the wives and families of the delegates there were three automobile trips; inspection trips to local industries called for special transportation facilities; there were a number of shorter trips in the city, and it was necessary to have facilities always at hand for any unforeseen development. Only one of the many trips was made by train, that to the Harrison Lamp Works of the General Electric Company.

Associations and Societies

Michigan Electric Light Association.—This association, which is the Michigan Division of the N. E. L. A., will meet at the Hotel Pantlind, Grand Rapids, on Sept. 18 to Sept. 20—not, as previously announced, on Sept. 11-13.

National Electrical Credit Association.—This association will hold a "silver jubilee convention" at Boston on Aug. 9 and 10. Almon Foster, Foster-McDonald Company, Boston, is the general chairman of arrangements.

Mountain Division "Electragists."—Arrangements are being made to hold a convention of the Mountain Division of the Association of Electragists International at the Albany Hotel, Denver, on July 16. James R. Strong of New York, who is president of the association, will address the convention, as will also John F. Greenawalt, Lawrence W. Davis and Arthur P. Peterson.

New England System Operators to Meet in Schenectady.—The System Operators' Club of New England, of which H. G. Jenks, Salem, Mass., is chairman of the executive committee, will hold a meeting at Schenectady, N. Y., July 12 to 14, under the auspices of the General Electric Company and in accordance with arrangements made by C. T. Mosman of the Boston office. Oil-switch and relay performance will be the subjects for discussion, with factory tests and demonstrations. The club is composed of system operators and load dispatchers of plants which are interconnected by high-tension transmission lines throughout New England. It was organized several years ago by R. S. Hale of the Edison Electric Illuminating Company of Boston and now has about fifty members.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published on the last page of this issue.]

Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.

National Electrical Credit Association—Boston, Aug. 9-10. F. P. Vose, 1347 Marquette Bldg., Chicago.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Investment Made with Honesty and Best Judgment Sustained.—Refusing to order the Lawrence Gas Company to reduce its gas rate or to cut down its net electric rate of 11¼ cents a kilowatt-hour, the Massachusetts Department of Public Utilities has just decided against the Mayor of Lawrence in a finding terminating a case which had been on the board's docket for a year. Action was deferred to permit expert examination on behalf of the city to determine what reduction, if any, could be made in rates. The return paid to the stockholders on their investment for the past ten years averaged slightly over 5½ per cent. The city attacked the amount of generating equipment owned by the company as excessive, but the company gave a reason in every instance for the existing size and equipment of its plant and properties. The commission held that, even though the company's judgment might in some instances be mistaken, a fair return should not be refused the company on capital "honestly and in the exercise of its best judgment invested in the plant."

Receipts from Sale of Appliances Must Be Reported as Miscellaneous Revenue.—Reflecting on what it regarded as a monopolistic tendency in the appliance-merchandising business of the Baltimore Gas, Electric Light & Power Company, though at the same time recognizing the popularity of this service with the company's customers, the Maryland Public Service Commission said, in the course of its recent order making heavy reductions in the company's gas and electric rates: "Under these circumstances we feel that we should not comply with the request of certain dealers who ask that the company be restricted in its merchandising activities and practices. We do not concede, however, as contended by the company's counsel, that the commission is powerless to prevent a public service corporation, enjoying the privileges of a monopoly through the protection afforded by the commission pursuant to legislative will and current economic thought, from employing those special rights and advantages to extend its monopolistic control over lines of endeavor that otherwise would remain individualistic and competitive. Yet, in the absence of an expressed or ascertainable public opinion on the subject, we believe that we should not at this time interfere with the company's merchandising department other than to order that the revenues from this branch shall be reported by the company and considered by the commission as other miscellaneous revenue. If the company desire that this revenue be treated in any other way, then capital for the merchandising department must be provided from an independent source and charges for rent and services must be made at adequate and remunerative rates."

"Average" Bills Where Meter Does Not Register Condemned.—A ruling affecting the collection of "average bills" by an electric or a gas utility from a consumer where the meter is found to be registering less than the full amount has been made by the California Railroad Commission, with the object of discouraging the presentation of such bills. The ruling was made as the result of the application of a gas corporation in southern California for permission to disconnect the service of a patron who had refused to pay an average bill presented by the company to reimburse itself for the alleged loss due to a defective meter. Investigation by the commission resulted in a report that the company had been lax in maintaining its meter-testing shops at the highest possible efficiency and had depended upon presenting average bills in cases of loss. The commission took the position that a utility is responsible for the condition of its meters, and that any loss occasioned by their inaccuracy should be borne by the utility unless it can prove that it was not at fault. Remarking that the courts were open to seek enforced collection of the bill, the commission refused permission to discontinue service.

Recent Court Decisions

That Facts Are Undisputed Does Not Make Negligence a Question of Law if Reasonable Men Can Draw Different Conclusions from Them. — Asserting that contributory negligence is a question of fact for the jury, even when the facts are undisputed, if reasonable men may draw different conclusions therefrom, the Court of Appeal for the Third District of California affirmed a judgment for the plaintiff in Pezzalia vs. San Joaquin Light & Power Corporation. In this instance a telephone lineman with fifteen years' experience who climbed a pole to put new brackets thereon, with knowledge that a single telephone wire extended from such pole under the high-voltage electric power line on other side of road about 18 in. or 2 ft. from such wire, was injured when the pole swayed, causing the telephone wire to come into contact with the high-voltage wire. "It is true," the court said, "that the danger was increased by the act of appellants in placing their wires so close to the telephone wire, but it should be a clear case of recklessness and indifference to consequences on the part of plaintiff that would permit appellants to maintain that, by reason of their own negligence, he should have abandoned his business rather than have subject himself to the increased peril. At any rate, we feel sure that it cannot be said, as a matter of law, that plaintiff's conduct in ascending the pole in pursuance of his duty as a lineman manifested such imprudence and want of caution as to make the consequences of his injury necessarily imputable to his own negligence." (214 Pac. 285.)*

Service Wrongly Shut Off Because of Dispute Over Bill.—The St. Joseph Gas Company, sued by one Randolph, was ordered to restore service which had been peremptorily discontinued because of plaintiff's refusal to pay a bill the correctness of which he disputed. The Kansas City Court of Appeals found that the company's right, under a rule approved by the Public Service Commission, to shut off gas if bills were not paid was not absolute, and when there was a bona-fide dispute by a customer who had always paid promptly the shutting off of the gas was arbitrary and outside the company's rights. Nominal damages awarded to the plaintiff were sustained. (250 S. W. 642.)

"Attractive Nuisance" Theory of Liability Especially Applicable to Instrumentalities on Public Streets. — In Znidersich vs. Minnesota Utilities Company damages were sought for injuries to a boy who climbed an electric transmission-line pole adjoining a vacant lot used as a playground to release a kite and came into contact with uninsulated wires heavily charged. The Supreme Court of Minnesota sustained a verdict for the plaintiff, holding that the rule of liability for maintaining dangerous instrumentalities attractive to children was particularly applicable to poles carrying electric wires where the poles are equipped with permanent contrivances serving the purpose of a ladder for climbing and are out in the open and in no way protected from free interference by children. (193 N. W. 449.)

Contracts Entered Into by City in Its Proprietary Capacity Not Different from Others.—In City of Billings vs. Montana Public Service Commission, the city sought to prevent the commission from compelling it to pay for heating service, resting its case on a clause in the contract with the utility supplying the service which stipulated that certain municipal buildings should be heated without charge. The city held that, even conceding that it could not enter into an inviolable contract fixing rates for its inhabitants, it did have that right respecting rates for itself in its proprietary capacity. This contention was denied by the Supreme Court of Montana, which, after asserting the commission's power to invalidate contracts even where they antedated its own creation, said: "Nor is there any basis for the city's contention that it is entitled to preference where its inhabitants would not be. The city is a consumer, as are its inhabitants who patronize the utility. Where the city receives its heat free, the utility's other patrons foot the bill." (214 Pac. 608.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Dean Walker Heads S. P. E. E.

Perley F. Walker, dean of the School of Engineering of Kansas University since 1913, was elected president of the Society for the Promotion of Engineering Education at its annual meeting held recently at Cornell University, Ithaca, N. Y. Dean Walker is a graduate of the University of Maine, his native state, and spent four years there as instructor and three years as professor

P. F. WALKER

of mechanical engineering. Since 1905 he has been associated with the University of Kansas. In addition to his duties with this institution he served as consulting engineer of the Wichita Natural Gas Company, Bartlesville, Okla., from 1914 to 1916 and since 1916 has been natural-gas consulting expert on the cost of supply of gas to the city of Kansas City, Mo. He has written many articles and papers on varied topics for engineering and educational journals and is a member of the American Society of Mechanical Engineers as well as of the Kansas Engineering Society.

C. D. Vail, railroad and hydraulic expert for the Colorado Public Utilities Commission, has been appointed a member of the commission to fill temporarily the place of Judge Tully Scott, who is ill and unable to perform the duties of his office.

W. H. Onken, Jr., editor of the ELECTRICAL WORLD, sailed for Europe July 4 on the Leviathan, to be gone for about three months. During this time Mr. Onken will visit the principal European countries whose development and use of electrical energy has assumed any considerable proportions. His visit will be for the purpose of obtaining first-hand information on electrical developments in Europe for publication in the columns of the ELECTRICAL WORLD.

Dan Harley, formerly associated with the Montana Power Company in Butte, has been made manager of the Deer Lodge (Mont.) Electric Company.

James C. Bennett, secretary and controller of the Westinghouse Electric & Manufacturing Company, was elected a director at the recent annual meeting of stockholders. Mr. Bennett succeeds John R. McCune, deceased. Other directors were re-elected.

F. H. Worthington, associated with the Jacksonville (Fla.) office of the General Electric Company, has been appointed local manager of that office to succeed G. C. Henry, who recently resigned. The appointment was announced by E. H. Ginn, district manager at Atlanta and became effective on the first of July.

C. H. Roessner has been appointed district sales manager at Chicago for the Foxboro Company, Inc., Foxboro, Mass., manufacturer of recording and indicating instruments. A. F. Mundy, formerly of the Chicago office, will represent the company in southern California, with offices in Los Angeles.

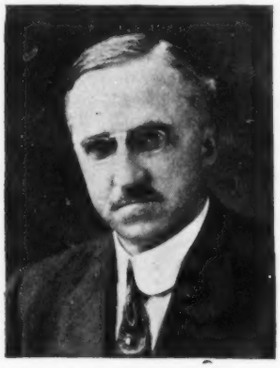
Charles P. Holmes has recently joined the Los Angeles sales organization of the Western Electric Company as appliance specialist. Mr. Holmes was formerly connected with the Havens Electric Company of Albany, N. Y., General Electric distributor in that section.

George E. Cockings, manager of the Bristol & Plainville (Conn.) Electric Company, has been elected president of the Tenney Service Association, an organization of leading men in the utilities managed by Charles H. Tenney & Company, Boston. For the past twenty-seven years Mr. Cockings has been manager of the electric railway, gas and electric properties at Bristol.

Philip S. Biegler, professor of electrical engineering at the State College of Washington, Pullman, Wash., has severed his connection with that institution. At the end of July Professor Biegler will leave for Los Angeles, where he will become head of the department of electrical and mechanical engineering at the University of Southern California. He is a graduate of the University of Wisconsin and has been associated with the electrical engineering departments of Purdue University, the University of Montana and the University of Illinois. Previous to his appointment at the State College of Washington Professor Biegler was an associate editor of the ELECTRICAL WORLD.

J. K. Bass Vice-President of Electric Power Club

James K. Bass, who was elected vice-president of the Electric Power Club at its recent convention at Hot Springs, Va., is the treasurer and general manager of the Kimble Electric Company, Chicago. Mr. Bass has been prominent in the activities of the Electric Power Club for a number of years. He became a member in 1911 as executive representative of the Kimble Electric Company, and in 1915 was elected chairman of the entertainment committee, serving in this capacity for five years. In 1921 he was elected to the board of governors and was appointed treasurer of the club. Mr. Bass was born in Chicago in 1872 and is a graduate of North-



J. K. BASS

western University. He has been treasurer and general manager of the Kimble Electric Company since 1909, and during that time has promoted the development and application of the single-phase variable-speed motor to numerous new fields, specializing particularly in the development of alternating-current motors for printing and allied industries.

F. W. Smith has been appointed division engineer of the Blackstone Valley Gas & Electric Company with headquarters at Pawtucket, R. I.

Stephen S. Mason has been appointed division engineer of the Blackstone Valley Gas & Electric Company with headquarters at Woonsocket, R. I.

E. F. Pearson, electrical engineer with the Northwestern Electric Company of Portland, Ore., was recently elected chairman of the Portland Section of the American Institute of Electrical Engineers. Mr. Pearson has been associated with the Northwestern Electric Company since 1912 as field engineer on transmission and distribution work, assistant superintendent of transmission and distribution and, since his return from service during the war, as electrical engineer. During the past year he served as secretary-treasurer of the Portland Section of the American Institute of Electrical Engineers.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Value of Uniform Cost Accounting*

The Basis of Price—the Influence of Interpreting Cost—Practical Benefits of Uniformity—How to Organize and Establish a Standard

By S. I. Whitestone
Comptroller General Electric Company

According to the latest reports compiled by the Chamber of Commerce of the United States, more than 125 trade associations have officially adopted uniform methods of cost figuring, and it is reported that a large majority of the members of these associations have been successfully operating under these systems. There are several reasons for the use of uniform cost methods by the members of any association.

If the contest for business is to be a healthy and fair contest, it must be conducted according to uniform rules well formulated and understood by all. As the price of an article is generally the prime consideration in the award of an order for supplies of like construction and quality, the attention of the contestants must be focused upon the rules which govern the establishment of the price. Of course, there are several ways of establishing a price. One is by agreement among manufacturers, but that is frowned upon by the government and has been put in the discard. Another is by cutting a competitor's price regardless of cost, and that is not done in good society.

Governing Selling Price

Another method of governing selling price is to add a percentage of profit to costs determined without regard to the competitor's cost methods, which sometimes results in a selling price so much in excess of the competitor's selling price that the figure must be arbitrarily cut to secure business, although the competitor's cost may be the wrong one. Finally, there is the setting of a selling price by adding a fair percentage of profit to the cost determined on the basis of a uniform system of cost accounting used by the majority of manufacturers of the same article.

Effect of Interpretation

Those who have been in intimate touch with the practical work of cost finding will appreciate that, notwithstanding strict adherence to general principles, it is possible to produce more than one cost result for a given article, depending upon the interpretation or application of any one of these general principles. For example, a manufacturer of fifty different kinds of electrical supplies may, in accordance with the manual, charge the cost of boxing, packing and shipping to "general manufacturing expense" and then apply it, as part of the overhead burden, prorated on the productive labor in the cost of each of the fifty devices. His procedure is correct and the cost of his product as a whole will be correct, but a competitor manufacturing the same fifty devices decides that containers for certain devices should be charged against the direct cost in the same way as raw material and that the balance of the boxing and packing expense which is not readily traceable to specific devices should be a part of the overhead. His cost will be correct as a whole, but will differ from the first manufacturer's cost for each of the fifty devices. Still another manufacturer may feel justified in applying untraceable expense of this character only to those of the devices which are not directly charged with the traceable cost of boxing. His costs will be correct as a whole, but will differ for the individual devices from those of the other two manufacturers. The same applies to the treatment of other factors entering into costs, such as transportation on incoming raw materials, cash discounts on purchases, shrinkage, spoilage and obsolescence, treatment of piece rates, day rates and bonus systems, overtime, cost of warehousing and many other factors too numerous to mention.

One of these methods and only one is correct; the others may not be so far off as to result in serious consequence; therefore the important thing for a trade association to decide is which of the various applications of general cost principles is the best one to meet the conditions. By having the members follow the methods so determined upon assurance is given that any difference in the cost of the devices represents an actual difference in the cost of production and not merely a difference in figures.

Structure Needed

When the majority of the interests constituting an association are sufficiently convinced of the advisability, or perhaps the absolute necessity, of uniformity of cost finding, then and only then may practical effect be given to these conclusions. That task will consist of five principal movements:

1. A "bureau of cost methods" should be established under the supervision of a committee of not more than three. It is essential that each of the members of this committee be one who has had practical experience in cost accounting and who is unequivocally in favor of uniform cost accounting. It may be desirable to empower this committee to employ one or more accountants on a salary and expense basis, as it will be the function of this committee to assist and guide members in the organization of their individual cost work.

2. The next step will be the appointment by each section or department of the association of a 'cost committee," which should include a representative from every member company, and preferably these representatives should be the

*A paper read before the Associated Manufacturers of Electrical Supplies, New London, Conn., June 27, 1923.

accounting officers of the member companies. It shall be the duty of these committees to study the methods of accounting and cost finding now in use by the section member companies and whenever certain features of these methods are not now treated alike by all the members to agree among themselves as to the best one of these methods to adopt as a standard. Individuals selected for membership upon these committees must be willing to devote much time and hard work to their task. They must be qualified by practical experience in accounting and cost work and by familiarity with the production problems of their respective industries to exercise sound judgment in the adoption of standards, to present convincing arguments in support of their ideas and to accept the viewpoint of others when such a course is deemed best for the membership at large. The chairman of each of these committees should, in addition to these qualifications, be possessed of considerable executive ability, without which the success of the committee work might be jeopardized. The selection of the right men to head these committees I consider of paramount importance.

3. These cost committees should agree upon a standard classification and definition of all accounts in one case, based upon the classification, definitions and terminology adopted by the Electrical Manufacturers' Council and set forth in the published manual. So far as possible the cost committee should adopt standard forms of records and reports which, if properly designed, will then be an important factor in encouraging adherence to the prescribed methods.

4. The cost committee's work should be preserved in the form of a manual which may be revised from time to time as found expedient, and that manual should then serve as a guide for all member companies. As such it will prove particularly helpful when for one reason or another a company finds it necessary to engage a new bookkeeper or cost accountant.

Financial Support

5. If the work of the committee is to be of real and lasting value, the sections must be willing to appropriate the necessary amount for maintenance of the "bureau of cost methods" and for the services of an accountant whose duty it shall be to review the accounting methods of every member to make sure that the agreed-upon standards are followed and, if not, to assist the delinquent member company in effecting such revisions as may be necessary. He should be provided with such assistance as he may require and be permitted to render similar service to non-members when the "bureau of cost methods" considers it to the best interests of the section to have such non-member instructed in the correct methods of determining and using costs.

I do not believe in the policy of maintaining a uniform accounting service by an association merely for the optional use of those members who are willing to pay for it. If the work is considered of value to the industry, the expense should be met by the association and become a part of the dues of the member companies so that all will be entitled to service.

It should be made very clear that with at least 90 per cent of the member companies of this association the adoption of a standard system will mean only slight changes in some details, but will accomplish important improvements. The other 10 per cent may have poor accounting systems and have done nothing to improve them because of

(1) inertia,

(2) confidence in occasional test checks or estimates without depending upon systematic records,

(3) unwillingness to incur expense, or

(4) fear of figures or inability to understand them.

Some Practical Advantages

The procedure for standardizing cost-finding methods, if applied to general accounting, will inevitably result in the adoption of standard forms of financial and operating reports. Just as the purchasing agent or engineer who buys a product must have greater confidence in the fairness of the selling prices when he is told that they are based on costs calculated on a standard basis, so will the bank and investor have greater confidence in and better understand financial reports when they are assured that the accounts shown therein are stated on the basis of standard definitions adopted by the industry.

In dealings with government departments smoother sailing will be enjoyed when the department is convinced that accounts and costs are determined according to a published standard system adopted by the majority of an industry. Regulatory and investigating government bodies seldom fail to recognize the propriety of practices openly and publicly concurred in as peculiar to an industry when not indulged in for unlawful purposes.

Compensating Workers

It is a trend of the times to compensate workers as nearly as possible in accord with their accomplishments rather than by periodical fixed salary payments, and any manufacturer who considers joining the large procession of companies that are supplementing the fixed salary and wage payments by compensation based upon operating results will find that the real value of such plans depends upon the confidence which the participants under the plan have in the accuracy of the figures that determine the amount of compensation they are to receive. When assurance is given to them that the basis for determining the results is one recognized as correct and adopted by other companies manufacturing the same product, it will avoid any question on the part of the employees as to the propriety of using such a system for the determination of their compensation.

In conclusion, I offer these concrete suggestions for the organizing of a cost-accounting service by a trade association and recommend it as a procedure for this body:

1. Canvass the membership for the names of those qualified to deal with this problem.

2. From this list select the names of three to serve on the committee of the association constituting the "bureau of cost methods"—one of these three to be made chairman or manager of the bureau.

3. Let the members of each of the sections submit to the "bureau of cost methods" the names of the individuals selected by them for membership upon their "cost committees."

4. Have the "bureau of cost methods" draft a general outline of the procedure for organizing the work of the cost committees and then arrange for a meeting of the chairmen of these committees to agree upon a program.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

NEW business continues to reflect quieter conditions in the electrical industry, although little apprehension is being expressed as to the future of trade. Central-station operations continue at a record-breaking pace both in output and in appliance sales. Back orders are far from fulfilled in manufacturing circles, and retail trade is healthy for this season.

Interest in electric ranges and refrigerating apparatus is widespread, but in the Northeast the fan trade has been poor owing to cool weather. Contractors are busy on wiring jobs, although the volume of new wiring business in sight is somewhat tempered by the slowing down of building projects resulting from inordinate wage demands on the part of organized labor.

In New England telephone service has been impaired in a few exchanges by a strike which began June 26 for higher wages and shorter hours, but the great majority of operators remained loyal to their duties and communication has been well maintained in most cities and towns of New England, Connecticut being outside the strike area.

Jobbers' stocks are reported adequate to meet current requirements, with firm prices in most lines and some weakness in flexible armored conductor and weatherproof wire. Careful financing is the rule in the electrical industry at present. A seasonal increase in radio apparatus sales is expected in about three weeks. Sockets and switches are moving a bit slowly this week.

Chicago Business More Active Last Week

GENERAL business in and around Chicago seems to have been a little more active this week than last. Wire is being offered in some cases at a lower figure, and from the indications it would seem that a lower price will be announced very shortly. Wiring-devices sales have been normal, high-tension equipment sales have kept up, and pole-line hardware demand is good. It is hard to obtain poles in some of the larger sizes, although some of the independents have considerable quantities on hand.

The conduit situation is getting worse. Shipments are lengthening into ten to fourteen weeks, although promises of delivery are made earlier. A careful analysis of the situation, taking into consideration the so-called slump in business and based upon the general situation as it appears here in relation to contracts already under way, indicates the possibility of a greater shortage of rigid iron conduit during the months of August, September and October than perhaps ever before in the history of the country.

Western Business Stimulated by Approaching Rate Raises

SAN FRANCISCO'S June building permits were $4,213,346, as against $3,336,701 for June last year. It is significant that the number of permits shows a 34 per cent increase as against 26 per cent value increase.

Retail business has been quite fair, the usual vacation season slump having been offset by the effect of numerous conventions. Factory ordering has been very heavy, stimulated by approaching increases of steamer rates and also by the fact that new carload and less-than-carload rates will be differentiated about 50 per cent. Hitherto they have been the same.

Tremendous crops are predicted, although net returns will not run much over last year because of considerably lower prices and dissension among several growers' associations. Exceedingly backward weather is reported in the Sierras with much snow still on the ground. Prices are fairly steady.

Reserve Board Says General Business Is Strong

THE Federal Reserve Board made public last week a summary of general business and financial conditions based upon statistics for May and June which was interpreted as an indication that the board did not find any alarming elements in the situation which might threaten a collapse of prosperity.

The board summed up its findings by declaring that the production and shipment of general orders continued in heavy volume during May, with the volume of employment sustained and many wage advances reported. The reports received showed that wholesale commodity prices declined during May and the early weeks of June.

As to the agricultural situation the board found that the condition of winter and spring wheat was less favorable than a year ago and the condition of the cotton crop slightly better. Banking and credit conditions were reported to be highly satisfactory.

"Production of iron and steel, cement and petroleum was larger in May than in any previous month, and mill consumption of cotton was close to maximum," the board says. "The high level of production in these industries, together with increases in practically all other reporting lines, is reflected in an advance of 2 per cent in May in the Federal Reserve Board's index of production in basic industries.

"In the building industry there was a further decline in principal cities in the value of permits granted which represent prospective building operations. Contract awards, however, which represent actual current undertakings, continued to increase, though declines are reported in the New York and Chicago districts.

Growing Interest in Electric Refrigeration

MANUFACTURERS of electric refrigerating plants report a well-sustained interest in this equipment, although during the past few weeks the demand has quieted down slightly as compared with the heavy volume of sales handled in the late winter and early spring. Central-station companies are becoming more aroused as to the value of this class of load, and power engineering departments are more active in soliciting this business. Apartment-house installations are multiplying and considerable development work is being done in the manufacturing field along the line of smaller outfits suited to medium-sized homes.

Advanced designs are receiving much attention, and producers report gratifying success in the field where some of these newer equipments have been on trial as it were for upward of a year. Prices are firm and steady since the advance of some months ago. Raw material and labor are still none too plentiful, and the outlook for the total business of this year is believed to be excellent.

Car Loadings Stay at 1,000,000 Mark

The car loadings exceeded the 1,000,000 mark for the week ended June 23, according to the American Railway Association. This marks the third week in which loadings have passed the 1,000,000 mark.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.034	$0.034	$0.0252
Cold finished shafting, per lb.	0.042	0.042	0.0325
Brass rods, per lb.	0.1850	0.1913	0.155
Solder (half and half), per lb.	0.2862	0.2812	0.22
Cotton waste, per lb.	0.1231	0.1231	0.104
Washers, cast iron (⅛-in.), per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	2.96	3.1[illegible]
Machine oil, per gal.	0.349	0.349	0.34
Belting, leather, medium, off list	42½%	42½%	46½%
Machine bolts, up to 1-in. x 30-in., off list	44½%	44½%	59½%

German Manufacturers and Electrical Construction Costs

DIRECTORS of several of the largest German electrical manufacturing companies at the recent annual meetings of their companies lamented the fact that the necessarily high prices of their products have prevented extensive purchases by central stations in Germany of larger-capacity units. An interesting commentary on the tremendous paper-mark investment required to build and equip new hydroelectric stations is afforded by the request of the Prussian government for additional funds with which to complete the several stations it has planned and started in the upper regions of the Weser River. The 1913 estimate for the new constructions was 10,000,000 marks. Work was interrupted by the war. It was not resumed until early in 1920, when the estimated cost was raised to 30,000,000 marks. From that time until the beginning of 1923 the estimate was repeatedly increased, until in January, 1923, it was placed at 5,918,870,000 marks.

Among the power plants under construction is the Talsperren-Kraftwerk Hemfurth, which will be used as a main station and which will be equipped with six turbines and generators. The estimated additional expense connected with this undertaking on account of high prices obtaining today is 475,000,000 marks.

Enlargement of the Kraftwerk Helminghausen by the Prussian State calls for an additional sum of 350,000,000 marks. The Werra Kraftwerk "Letzter Heller" will cost 1,200,000,000 marks more than originally estimated.

Extension of the transformer station at Bueren requires a further expenditure of 760,000,000 marks in order that it may be able to serve the Bueren and Brilon districts satisfactorily. A power station at Berka calls for 785,000,000 marks more than originally estimated. This station serves the districts Nordheim, Duderstadt and Osterode.

To improve the service given to the city of Cassel a transforming station on the Losse River will be built at a cost of 254,000,000 marks in excess of the original estimate.

Among the more important transformer stations which are to be completed at a further expense, as estimated in January, 1923, of 90,000,000 marks each are those at Frankenberg and Borgholtz.

The Metal Market

MOST of the larger producers still adhere to the 15-cent level, and whether they will reduce their price below this or not remains to be seen. It is purely a nominal quotation, and this price has not been realized except on an occasional carload. Some of the inquiries have been for small tonnages for prompt shipment, but there seems to be an aversion to buy for other than immediate requirements except at marked concessions. The reduced prices at which some custom smelters have been willing to do business only hold for comparatively large lots.

It is encouraging to note that some large buyers have taken substantial tonnages at 14.625 and 14.75 cents, delivered, indicating that they think copper a good "buy" at those levels. Should a buying movement of even moderate dimensions set in, the amount of copper available below the nominal quotations of most of the producers would be taken up quickly.

The export market has also been unsatisfactory during the week, though one good-sized order was received. Germany has taken nothing, and the other European countries only moderate amounts. The price, however, has been from ⅛ cent to ¼ cent above that realized on domestic business.

The official price for lead of the American Smelting & Refining Co. was reduced from 7.25 cents, New York, to 7 cents. The reduction was caused by the fact that weakness in the foreign market again made importation possible.

The lower price increased buying in the East somewhat, though the market has certainly not been active. Producers are well sold up with current production, however, and specifications continue good, so that there is no pressure to sell below the level of the Smelting company.

NEW YORK METAL MARKET PRICES

	June 28, 1923 Cents per Pound	July 3, 1923 Cents per Pound
Copper, Electrolytic	14.87½ to 16.00	15.00
Lead, Am.S.& R.price	7.25	7.00
Antimony	7.50	7.50
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.00	5.80
Tin, Straits	41.00	41.00
Aluminum, 98 to 99 per cent	26.00	26.00

Gain of Only $31,142 Shown in May Electrical Exports

TOTAL exports of electrical machinery, apparatus and appurtenances for May were $5,396,943, a gain of only $31,142 over May, 1922, when the total amounted to $5,365,801. In April, 1923, total electrical exports amounted to $5,981,191. The accompanying figures are supplied by the Bureau of Foreign and Domestic Commerce.

ELECTRICAL EXPORTS FOR MAY, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

Articles	Value May 1922	Value May 1923
Turbines	$137,005	$47,603
Generators:		
Direct-current:		
Under 500 kw.	70,511	73,459
500 kw. and over	33,170	50,780
Alternating-current:		
Under 2,000 kva.	9,469	1,557
2,000 kva. and over	12,729	34,600
Accessories and parts for generators	49,828	54,445
Self-contained lighting outfits	54,579	74,869
Batteries:		
Primary	106,755	115,742
Storage	140,220	229,229
Transforming and converting apparatus:		
Transformers—		
Power	515,366	129,494
Other	46,302	63,680
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	74,832	33,831
Transmission and distribution apparatus:		
Switchboard panels, except telephone	253,490	156,760
Switches and circuit breakers above 10 amp.	194,229	119,316
Fuses and fuse blocks	15,442	30,983
Meters and measuring instruments:		
Watt-hour and other measuring instruments	40,132	39,709
Volt, watt and ampere meters and other recording, indicating and testing apparatus	76,308	74,561
Lightning arresters, choke coils, reactors, and other protective devices	66,765	23,372
Motors, starters and controllers:		
Motors under 1 hp.	76,472	236,970
Stationary motors 1 to 200 hp.	206,933	238,544
Stationary motors over 200 hp.	37,312	20,715
Railway motors	2,245	19,391
Electric locomotives:		
Railway		206,484
Mining and industrial	10,900	3,525
Other motors	29,760	13,712
Rheostats, controllers, and other starting and controlling equipment	67,239	133,703
Accessories and parts for motors	100,370	142,600
Electrical appliances, etc:		
Electric fans	70,794	54,788
Electric lamps:		
Incandescent—		
Carbon-filament	5,751	3,923
Metal-filament	97,109	92,691
Other electric lamps	24,578	20,596
Flashlights	23,797	47,447
Searchlights and projectors	3,509	8,772
Motor-driven household devices	53,722	78,678
Domestic heating and cooking devices	47,554	84,121
Industrial electric furnaces and ovens	6,132	16,828
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	59,058	84,558
Signal and communication devices:		
Radio and wireless apparatus	186,525	213,025
Telegraph apparatus	6,835	23,317
Magneto telephones	(*)	31,259
Other telephones	434,287	20,986
Magneto switchboards	(*)	5,934
Other telephone switchboards	(*)	130,190
Railway signals, switches and attachments	8,239	29,214
Bells, buzzers, annunciators and alarms	5,176	5,628
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos, and other ignition apparatus	103,705	90,433
Insulating material	83,854	132,634
Metal conduit, outlet, and switch boxes	15,147	54,418
Sockets, receptacles, and lighting switches	20,963	125,738
Other wiring supplies and fixtures	102,968	139,010
Other electrical apparatus not elsewhere specified	876,791	636,756
Globes and shades for lighting fixtures	43,300	34,538
Electrical glassware, except for lighting	10,246	16,012
Electrical porcelain	117,588	123,284
Electrical carbons, carbon brushes and electrodes	132,582	190,968
Insulated wire and cable (iron or steel)	21,104	33,678
Other manufactures of aluminum	88,386	102,975
Copper—		
Bare wire	140,067	100,969
Insulated wire and cable	146,671	293,941
Total electrical machinery, apparatus and appurtenances	$5,365,801	$5,396,943

(*) Not separately stated prior to Jan. 1, 1923.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Electric Range Factory Opened by Landers, Frary & Clark

To meet the increasing demand for electric ranges, Landers, Frary & Clark, New Britain, Conn., have recently built a new factory six stories in height, 160 ft. long and 60 ft. wide, for exclusive use in range production, and at this writing are occupying the plant and beginning active manufacturing therein. Representatives of the company state that interest in electric cooking is growing throughout the country, the South in particular having recently developed very actively as a field, following a long period of less apparent interest.

A. F. Wakefield Elected Vice-President of Wakefield Brass

A. F. Wakefield was elected vice-president of the F. W. Wakefield Brass Company of Vermilion, Ohio, at the annual meeting held recently, the other officers remaining unchanged. Mr. Wakefield joined the company four years ago as assistant to the sales manager and has made rapid strides in the organization.

Standard Underground Cable Appoints G. H. Hawley Manager

George H. Hawley has been appointed manager of the metal departments of the Standard Underground Cable Company's Perth Amboy (N. J.) works to fill the vacancy caused by the death of C. C. Baldwin, which occurred on June 7.

Mr. Hawley has been production manager for the past three years of the departments in question, which include the melting furnaces, rod, wire brass and tube mills and those for the manufacture of weatherproof and magnet wire. He has had wide experience in such work and before going with the Standard Company was connected with the National Conduit & Cable Company at Hastings-on-the-Hudson and for many years with the American Brass Company at Ansonia.

Cowan Truck Appointments

New representatives of the Cowan Truck Company, Holyoke, Mass., have been appointed as follows:

American Machinery & Supply Company, 1113 Howard Street, Omaha; Hendrie & Bolthoff Manufacturing & Supply Company, Denver; E. E. Johnson, 207 S. & L. Building, Des Moines; H. A. Hildebrandt, 324 Fourth Avenue South, Minneapolis, and H. K. Dyer, 178 Middle Street, Portland, Me.

J. M. Eaton, general manager of the Cowan company, stated last week that owing to increasing interest in material handling by industrial electric lift trucks, hand-lift trucks and skid bodies, increased factory facilities are being provided at Holyoke. Business is well diversified and widely distributed.

General Electric's New Plant at Philadelphia

The General Electric Company has decided to proceed with the erection of a new plant at Philadelphia, initially projected a number of months ago, and has taken bids on a general contract for the first plant unit, to be two story, 190 ft. x 604 ft., estimated to cost about $500,000, including equipment. The award will be made at an early date. The company has a tract of land on Elmwood Avenue between Sixty-eighth and Seventieth Streets, totaling about 21 acres, providing space for proposed later expansion.

Pelton Water Wheel Appoints E. M. Breed Sales Manager

E. M. Breed, for several years past assistant manager of sales for the Pelton Water Wheel Company, has been appointed sales manager, with his headquarters in San Francisco. Mr. Breed has had a wide experience in hydro-electric work, having been connected with the Pelton Water Wheel Company in various capacities for the past fifteen years.

Acquires the Washkosh Power Washing Machine Business

Perry E. Haworth, Chicago, has taken over all of the tangible property of the bankrupt Washkosh Manufacturing Company, Milwaukee, maker of the Washkosh power washing machines. This business was formerly conducted by J. Bolduc of Cleveland, who was president of the concern, and Warren Lee, secretary. Mr. Haworth's bid of $10,000 was accepted by the trustee in charge of the sale.

It is the plan of the new owner to continue the manufacture of the machines in Milwaukee, where the business was started. For the present the old plant will be operated and activities will start as soon as the title has passed and operation is possible. A force of twenty-five or thirty men will be employed.

The sale included all of the complete equipment of the plant, together with patents, good will, raw material, partly finished machines and some completed washers. A voluntary petition in bankruptcy was filed by this company in May, scheduling liabilities at $100,440 and assets at $20,262.

Elliott Company Changes in Sales Organization

The Elliott Company, manufacturer of power accessories, Pittsburgh and Jeanette, Pa., announces the following changes in its sales organization:

M. C. Sickels, formerly district manager of the Cleveland office, is now in charge of the Chicago office. C. H. Swett, who has been connected with the Philadelphia office for a number of years, becomes district sales manager of the Cleveland office.

After one year's apprentice training through all of the departments of the shop, engineering department and office, the following men have been assigned to sales work in district offices, as follows: R. W. Fox, New York; J. H. Strickler, Pittsburgh; J. A. Gerlach, Cincinnati; C. H. Hosterman, Detroit; C. F. Harms, Chicago.

All of the above changes concern also the sales work of the Liberty Manufacturing Company and Lagonda Manufacturing Company, subsidiaries of the Elliott Company.

Roller-Smith Appointment

The Roller-Smith Company, 233 Broadway, New York City, announces the appointment of H. D. Baker, 525 Woodward Avenue, Detroit, as its representative in Michigan. Mr. Baker will handle the Roller-Smith Company's lines of instruments, circuit breakers and radio apparatus in that territory.

Allis-Chalmers Bookings Totaled $14,912,015 in Five Months

Bookings of the Allis-Chalmers Manufacturing Company far exceeded production. In the first five months of the year they totaled $14,912,015, an increase of 58.7 per cent, and unfilled orders now exceed $13,000,000, compared with $8,215,545 Jan. 1.

Although demand has increased in practically all lines, it is felt most in the electrical and steam-turbine departments. Sales in the former line are now 40.5 per cent of total business, compared with 35.5 per cent a year ago, and turbine sales are 15.5 per cent compared with 10 per cent. Difficulties in getting sufficient unskilled labor and semi-skilled foundry workers are largely responsible for keeping operations at only 70 per cent of capacity. Actual billings against the $14,012,015 orders in the first five months of the year have been $9,158,378.

May net after taxes was $203,044, or $20,907 in excess of monthly dividend requirements on both classes of stock. Early in the year earnings were slightly under dividend requirements, so that the five months' figure of $862,172 was $48,515 less than the dividends for the period.

This means that $230,650 must be earned in June to meet dividends in the first half year. Officials believe this can be done since earnings have shown a steadily increasing tendency for some time.

In 1922 total annual dividend requirements of $2,185,641 on the 16,500,000 7 per cent preferred and $26,000,000 common, on which $4 a share is paid, were earned with some margin. Net income after taxes was $2,208,549, compared with $2,215,468 in 1921.

Westinghouse May Bookings Were $18,000,000

The Westinghouse Electric & Manufacturing Company's May bookings were about $18,000,000, compared with $17,741,000 in April. Orders for the current month are expected to be some 10 to 12 per cent lower on account of the combination of a recession in business, which is partly seasonal and which is regarded as a temporary condition, and the fact that June is a short month.

In the first quarter of 1922 bookings totaled only $32,118,924, less than the combined orders for the first two months this year, and Westinghouse has not included the $15,000,000 Virginian Railway electrification contract in its monthly orders yet, indicating the tremendous volume of incoming business received this year.

Sales billed for the first two months of the fiscal year were $23,000,000, and June billings will be substantially better than either of the two preceding months. For the first quarter last year ended June 30 billings were $25,713,707.

Westinghouse is increasing its production as rapidly as possible and is establishing a gain of 10 to 15 per cent monthly in this direction. As with the majority of industries, Westinghouse faced a labor shortage at the beginning of the year, but the situation has improved. The company is estimated to be operating now at around three-fourths of capacity.

Its cash position has improved substantially since the first of the year, and the company has on hand a comfortable supply of cash and Liberty bonds. As of March 31 this item amounted to $7,848,691, but with sale of $14,962,530 additional common stock in April its position was strengthened materially.

Link-Belt Sales Schools

The Link-Belt Company, 910 South Michigan Avenue, Chicago, announces that it has adopted the policy of holding annual sales schools. The most recent of these schools was held at the Link-Belt Indianapolis factory June 4, 5 and 6. The salesmen, eighteen in number, came from the Detroit, Pittsburgh, Toronto, Chicago, Boston, New York, Kansas City, St. Louis and Dallas offices.

Not only does this school permit the men to see and inspect the various malleable and steel chain manufactories and meet the offices and department heads of the plants, but the interchange of ideas among the men themselves, coming as they do from such widely separated points, makes for better feeling, fraternity and a dissemination of valuable sales information.

George Torrence, sales manager, with headquarters at Indianapolis, said with regard to the last school: "This is the third sales school we have conducted, and the value of such schools becomes more apparent every year. The men are inspired and benefited by their association with the factory and home-office men for three days, and the increased volume of sales resulting from the men who have attended our schools has shown us conclusively that the schools are a paying investment from a dollars-and-cents standpoint. This is aside from the intangible yet great value obtained through the better understanding and the clearer perspective that are naturally consequent upon such a gathering."

The Enamelight Company, 546 Book Building, Detroit, recently organized to manufacture electric lighting equipment, has plans for the establishment of a new works. Permission has been received to dispose of preferred stock in the amount of $80,000 for initial operations.

The C. M. Hall Lamp Company, 1033 East Hancock Street, Detroit, manufacturer of electric lighting equipment, has awarded a general contract for a one-story addition, 80 ft. x 175 ft., to cost approximately $75,000.

The Bates Standard Steel Truss Company, Chicago, manufacturer of poles for transmission lines, is erecting an experimental and testing plant adjoining its East Chicago (Ind.) works.

The 44 Safety Electric Lantern Company, Inc., 623 Calvert Building, Baltimore, recently organized, has tentative inquiries out for equipment and materials for electric lantern manufacture.

The American Electric Motors, Inc., 57 Erie Street, Milwaukee, manufacturer of electric motors, has increased its capital stock to finance purchases of additional equipment and materials and generally accommodate increased business. The preferred stock has been increased from $100,000 to $150,000 and the common shares from 3,000 to 3,500. C. L. Daun is president and general manager.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has awarded a contract to the Somersville Ornamental Iron Works, Sharon, Pa., for the erection of an addition to its Sharon plant, soon to be occupied for the manufacture of transformers. Other buildings will be constructed at a later date on adjoining property recently acquired. It is expected to have the plant ready for production by Oct. 1.

The Robert Findlay Manufacturing Company, 100 Lexington Avenue, Brooklyn, N. Y., manufacturer of lighting fixtures, has filed plans for extensions and improvements in its plant to cost $22,000.

The Western Electric Company has advised the municipal officials at Kearney, N. J., the site of its proposed Eastern plant, that plans are being developed for a larger works than initially projected, to make a total investment of $20,000,000 during the next twenty-four months, instead of $5,000,000, as previously announced. Other plant units will be constructed and the works materially enlarged over the first plans. Ground will be broken for the initial group of buildings at an early date.

The Line Material Company, New York City, has leased space in the building at 524-26 East One Hundred and Thirty-fourth Street for local operating and warehouse service.

The General Electric Company will commence the erection of a small one-story addition to its Sprague Works, Lawrence Street, Bloomfield, N. J. Superstructure work is under way for additions to the plant on Norman Street, Everett, Mass., comprising three one-story buildings, 50 ft. x 75 ft., 65 ft. x 140 ft., and 41 ft. x 60 ft., to cost about $60,000.

The Century Electric Company, Pine Street, St. Louis, is considering plans for enlargements in its plant, including the installation of additional equipment, estimated to cost $350,000.

The Connecticut Blower Corporation, Hartford, Conn., has been incorporated with capital stock of $250,000 to manufacture mechanical-draft equipment, including blowers, exhaust, conveying and ventilating systems. The corporation is successor to the International Blower Company, the Connecticut Blower Company and the Hartford Sheet Metal Works.

The George Cutter Manufacturing Company, North Notre Dame Street, South Bend, Ind., manufacturer of outdoor electric lighting equipment, etc., affiliated with the Westinghouse Electric & Manufacturing Company, has tentative plans under consideration for the erection of an addition to its plant, to be used for increased production.

J. B. McIntosh, formerly purchasing engineer of the National Lamp Works of the General Electric Company, Cleveland, has opened an office in the Keith Building, Cleveland, as purchasing and consulting engineer, under the name of the J. B. McIntosh Company.

The Magnus Electric Company, Inc., New York, has established a Chicago branch office at 231 North Wells Street, Leo Hirschfell and M. B. Geiger in charge.

The Majestic Appliance Company, Inc., San Francisco, recently organized, has taken over the local plant and business of the Majestic Electric Development Company, 656 Howard Street. The new company will continue in the manufacture of electric heaters and plans for expansion for production of a line of electric appliances. A. T. Burt is president and T. M. Simpson, vice-president and general manager.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Algiers, Africa (No. 6,994), for electric automobiles.

Purchase and agency is desired in Christiania, Norway (No. 7,044), for electrical cooking and heating devices, vacuum cleaners, etc.

Purchase is desired in Warsaw, Poland (No. 6,977), for military telephone and telegraph systems.

An agency is desired in Helsingfors, Finland (No. 7,034), for wiring devices, porcelain insulators, copper wire, cooking and heating appliances, incandescent lamps, equipment for high-voltage systems, etc.

Purchase is desired in Calatayud, Spain (No. 7,025), of iron products and leaded iron sheets for insulating tubes.

PROPOSED IMPROVEMENT TO THE ALGERIAN TELEPHONE SERVICE.—In a report recently submitted by the Commercial Syndicate of Algiers to the colonial authorities at Paris, *Commerce Reports* states, changes and improvements needed in the Algerian telephone service are suggested. The equipment is twenty-five years behind that in the United States and the present repair requirements would be more onerous than would be the complete rebuilding of the system. The present long-distance service is hopelessly inadequate.

New Apparatus and Publications

DRYING TUMBLER. — A new clothes drier, "C. & F.," has been developed by the Carlisle & Finch Company, 221 East Clifton Avenue, Cincinnati.

SOLDERING OUTFIT. — An electric soldering outfit designed especially for jewelers and opticians has been placed on the market by the E. & J. Swigart Company, 28 West Sixth Street, Cincinnati.

INCLOSED SWITCHES.—The Mutual Electric & Machine Company, Detroit, has added to its "Bulldog" products a line of inclosed switches, under the name of "Junior."

TRANSFORMER TEMPERATURE SIGNAL.—The Packard Electric Company, Warren, Ohio, has placed on the market the "Packard" transformer temperature signal.

ELECTRIC FANS.—The Emerson Electric Manufacturing Company, 2018 Washington Avenue, St. Louis, is distributing bulletin No. 4,024-A, covering the "Emerson" fan motors for alternating and direct current.

COMMERCIAL LIGHTING UNIT.—A new commercial lighting unit, known as "Sol-Lux," has been brought out by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC IRON.—The Russell Electric Company, 340 West Huron Street, Chicago, has developed a new "Hold-Heet" electric iron.

LIGHT METER.—The Holophane Glass Company, 342 Madison Avenue, New York City, has issued a booklet describing the new "Holophane" light meter and giving instructions regarding its use.

DEEP-WELL PUMP.—A new type of deep-well pump, under the name of "Axiflo" pump, has been developed by the Worthington Pump & Machinery Corporation, 115 Broadway, New York City.

WASHING MACHINE.—The Clements Manufacturing Company, 613 Fulton Street, Chicago, has placed on the market a new "Cadillac" washing machine equipped with a disappearing wringer.

WATER SOFTENER.—"Zero or One and One-Half, Which?" is the title of a booklet published by the Graver Corporation, East Chicago, Ind., describing the "Graver" hot-process water softener for treating boiler-feed water.

WOOD PRESERVER.—The C-A Wood Preserver Company, Arcade Building, St. Louis, is distributing a booklet entitled "Thirty-six Years' Evidence that 'C-A-Wood Preserver' (Carbolineum America) Will Stop That Rot," in which it describes the method of production of "C-A-Wood Preserver" and gives an outline of various uses of the preservative.

CENTRIFUGAL PUMP. — The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing leaflet No. 2,064, describing its "S" pump line.

BOILER-FEED PUMPS. — The Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., has issued catalog WC, covering the "Bethlehem-Weir" (land service) pumps for boiler feeding and other duties.

ILLUMINATING DATA.—The Holophane Glass Company, Inc., 342 Madison Avenue, New York City, has issued a new publication in which it gives illuminating engineering data and describes the "Holophane" lighting apparatus, etc.

CONTROL RELAYS.—Bulletin No. 47,672, issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its instantaneous-control type PB-53 hesitating-control type PB-54 control relays.

TEST TABLES.—A new catalog, No. 1, section 3, describing test tables for central-station meter departments, has been issued by the States Company, Hartford, Conn. The illustrations show table units, wiring connections and applications, with special tables designed for unusual conditions.

New Incorporations

THE TWIN BRANCH POWER COMPANY, South Bend, Ind., has been incorporated to furnish light, heat and power. The directors are T. F. English, J. F. Leftus, C. B. Calvert, J. W. McInery and A. H. Huguenard.

THE SHORE ACRES ELECTRIC COMPANY, Fairmount, Minn., has been incorporated by E. W. Edwards and H. H. Drewes. The company is capitalized at $25,000 and proposes to establish a light and power plant.

THE LONGVIEW (WASH.) PUBLIC SERVICE COMPANY has been incorporated with a capital stock of $2,500,000 to furnish water, light and power to the Long-Bell Lumber Company, Longview. The incorporators are: S. M. Morris, Wesley Vandercook, L. C. Smith, J. M. Legland and L. D. Beach.

THE EAST MISSOURI POWER COMPANY, Troy, Mo., has been incorporated with a capital stock of $100,000 by William Knight, V. K. Nickell and E. H. Bartow.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HAVERHILL, MASS. — The Haverhill Electric Company has applied for permission to issue $376,740 in capital stock, part of the proceeds to be used for expansion.

HOLYOKE, MASS. — Preliminary work has started on the new boiler house and power plant for the Farr Alpaca Company in Jackson Street. The cost is estimated at about $1,000,000.

PAWTUCKET, R. I. — The Blackstone Valley Gas & Electric Company is preparing plans for the erection of an addition to its generating plant, additional substations and extensions to transmission lines, to cost about $2,500,000.

Middle Atlantic States

BROADALBIN, N. Y.—The Broadalbin Electric Light & Power Company has applied to the Public Service Commission for permission to construct an electric light plant in Perth.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 17 for five electric grinders for the South Brooklyn Navy Yard. (Schedule 1029.)

CARTHAGE, N. Y.—Electric power equipment will be installed at the plant of the Carthage Sulphite Pulp & Paper Company in connection with the rebuilding of its plant, recently damaged by fire. The loss is estimated at about $200,000.

CHAZY, N. Y.—The Plattsburgh (N. Y.) Gas & Electric Company has been granted permission to extend its transmission lines in Chazy for which a franchise has been granted by the Town Board.

SCHENECTADY, N. Y.—The Adirondack Power & Light Corporation has issued $1,200,000 in bonds, part of the proceeds to be used for extensions to transmission lines and power plants, including a hydro-electric station of 30,000 kw. capacity.

VESTAL, N. Y. — The Vestal Lighting Company has petitioned the Public Service Commission for permission to extend its lines in portions of the town of Vestal.

BRANCHVILLE, N. J. — The Culvers Hydro-Electric Company has purchased the property of the Branchville Electric Power, Water & Light Company. Capital stock for $90,000 will be issued, the proceeds to be used to acquire the system and for proposed extensions.

ELIZABETH, N. J. — Electric power equipment will be installed in the printing plant to be erected at Broad and Chestnut Streets by the Elizabeth *Daily Journal*, to cost about $160,000. C. Godfrey Poggi, 275 Morris Avenue, is architect.

IRVINGTON, N. J.—The Public Service Electric Company, Newark, plans to construct an addition to its local substation.

NEWARK, N. J.—Electric power equipment will be installed in the printing plant to be erected by the Newark Call Printing & Publishing Company at 91-93 Halsey Street, to cost about $150,000.

NEWARK, N. J.—Bids will be received by Charles P. Gillen, director Department of Parks and Public Property, until July 10, for lighting fixtures for the new municipal Center Market and Parking Station.

NEWARK, N. J.—The Goerke Company, 701 Broad Street, will build a power plant on Halsey Street, with electric generating department for emergency service, to be used in connection with its proposed department store, to cost about $5,000,000. William E. Lehman, 738 Broad Street, is architect.

NEWARK, N. J.—Electric power equipment will be installed in the proposed meat-packing and refrigerating plant to be erected on Plum Point Lane by the Greater Newark Packing Corporation, recently organized with a capital of $500,000. Michael J. Quigley, 738 Broad Street, represents the company.

CARLISLE, PA. — The Carlisle Gas & Water Company has received permission to take over and operate the plants of the West Pennsboro & Carlisle Electric Company and the North Middleton & Carlisle Electric Company. The properties will be merged and extensions made in the systems.

HARRISBURG, PA.—The board of school directors will build a power plant at the new senior high school, Sixth and Division Streets. G. Howard Lloyd, Telegraph Building, is architect.

KENNETT SQUARE, PA. — The Tidewater Transit Company, recently organized to take over the West Chester, Kennett Square and Wilmington Electric Railway, contemplates improvements, including electric power apparatus, transmission and feeder lines, etc., to cost about $150,000. Samuel E. Cooper heads the new company.

OIL CITY, PA.—The Citizens' Light & Power Company contemplates altering its distribution system and rerouting the light and power lines, etc., to cost about $50,000. Day & Zimmerman, Inc., 611 Chestnut Street, Philadelphia, are engineers.

PHILADELPHIA, PA. — The Philadelphia Electric Company has issued $10,000,000 in capital stock, part of the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company will make extensions and improvements to its power house at Thirteenth and Vernon Streets, to cost about $25,000.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 10 for armature, brushes, holders, etc., for the Philadelphia Navy Yard. (Schedule 1027.)

RURAL VALLEY, PA.—The Rural Valley Borough Electric Corporation, recently organized, plans to install a system for commercial light and power service. McCahill, McCahill & Tabor, 908 West Penn Building, Pittsburgh, are representatives.

RUTHERFORD, PA. — Electric power equipment will be installed at the proposed local coaling plant to be constructed by the Philadelphia & Reading Railway Company, Reading Terminal, Philadelphia, to cost about $500,000.

SALFORD, PA.—The Salford Power & Light Company is being organized to install and operate a local commercial system for

light and power service. Thomas J. Perkins, Allentown, represents the company.

SHARON, PA.—Arrangements have been made by the Shenango Valley Electric Light Company to erect a transmission line, about 5 miles long, to serve the village of Hartford, Ohio. M. Pendleton is superintendent.

BEECH BOTTOM, W. VA.—The Kerr Portland Cement Company, Wheeling, has acquired about 800 acres of land in Beech Bottom, on which it proposes to erect a cement plant with an initial capacity of 3,000 barrels per day. The project will include power house and machine shop. The cost is estimated at about $1,300,000.

BLUEFIELD, W. VA.—The Premier Red Ash Coal Company plans to install electric power and mechanical equipment at its properties in the Clinch Valley section.

FAIRMONT, W. VA.—The Baltimore & Ohio Railroad Company has tentative plans for the electrification of its line from Fairmont to Keyser, W. Va., including substations and feeder system.

McDOWELL, W. VA.—The Pond Creek Pocahontas Coal Company plans to install electric power equipment and mechanical apparatus at its local mining properties. A fund of $1,000,000 is being arranged for expansion.

MULLENS, W. VA.—D. D. Moran plans to construct a power house in connection with a new lumber mill, to cost about $50,000.

POCAHONTAS, W. VA.—The Pocahontas Fuel Company plans to install electric power and mechanical equipment at its Wyoming County properties.

CLAREMONT, VA.—The City Council is considering granting a franchise for furnishing electricity in the town for lamps and motors.

KING GEORGE, VA.—The King George County School Board plans to install an electric plant for service at the local schools.

NANSEMOND, VA.—Electric power equipment will be installed in the proposed local automobile plant to be constructed by the Robe Motor Corporation of Virginia, Arcade Building, Norfolk, recently formed with a capital of $500,000. W. B. Robe is general manager.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until July 18 for ammeter, relays and other miscellaneous equipment for the Canal Zone. (Circular 1541.)

North Central States

ALGER, MICH.—The installation of an electric lighting system is being agitated by local business men and residents.

LANSING, MICH.—The Public Utilities Commission has granted the Wolverine Power Company permission to issue $2,500,000 in bonds, the proceeds to be used for the construction of four dams on the Tittabawassee River in Midland and Gladwin Counties. The company proposes to sell its power to the Consumers' Power Company. The officers are: J. M. Bick, Toledo, Ohio, president; William P. Manchester, Detroit, vice-president, and R. Holland, Ann Arbor, engineer.

COLUMBUS, OHIO.—The Columbus Belt Railway Company contemplates building a belt line railway around the city, 12 miles, to cost from $12,000,000 to $15,000,000.

YOUNGSTOWN, OHIO.—The Pennsylvania-Ohio Power & Light Company is erecting a high-tension transmission line (10 miles long), with substation, to supply electricity to the village of Orangeville.

CROWN POINT, IND.—A power plant will be erected at the new local sanitarium, to cost about $350,000 for which bids will be received until Aug. 1. Karl D. Morris, Calumet Building, East Chicago, is architect. The Crown Point County Commissioners are in charge.

FORT WAYNE, IND.—The Wabash Valley Electric Company is negotiating for the purchase of the systems of the Martinsville (Ind.) Gas & Electric Company, Putnam Electric Company, Greencastle, Morgan County Light & Power Company, Morgantown; Spencer (Ind.) Light, Power, Heat & Water Company, Roachdale (Ind.) Electric Company and the Gosport (Ind.) Electric Company. The properties will be merged, and extensions and improvements made.

WARSAW, IND.—The Interstate Public Service Company has prepared plans for an electrically operated pumping plant for the local waterworks, to cost about $100,000.

JOLIET, ILL.—The Eagle Paper Company contemplates extensions to its power plant, including the installation of new equipment. Cahill & Douglass, 217 West Water Street, Milwaukee, are engineers.

VENICE, ILL.—The local power plant of the Madison County Light & Power Company, Granite City, was recently damaged by fire.

BEAVER DAM, WIS.—The Wisconsin Light, Power & Heat Company contemplates the erection of a high-tension transmission line along the Beaver Dam highway for a distance of 10 miles, to cost about $25,000.

PESHTIGO, WIS.—Plans are being prepared by the North Eastern Power Company, 559 Marshall Street, Milwaukee, for the installation of a 4,000-kva. generating unit and other improvements to its local plant, to cost about $50,000. Mead & Seastone, Journal Building, Madison, are engineers.

PHILLIPS, WIS.—Steps have been taken by the Phillips Commercial Club for the installation of an ornamental lighting system on Lake Street.

DULUTH, MINN.—Contract has been awarded by the McDougal Terminal Warehouse Company for the erection of a power house at 809 West Railroad Street, to cost about $20,000.

MANKATO, MINN.—The installation of a new street lighting system is under consideration by the City Council.

TOLEDO, IOWA.—The construction of a power house at the State Juvenile Home, to cost about $40,000, is under consideration. A. E. Kepford is manager.

WEST LIBERTY, IOWA.—The North Eastern Electric Company, 559 Marshall Street, Milwaukee, contemplates erecting a transmission line to West Liberty.

TROY, MO.—The East Missouri Power Company, recently organized, plans to install a light and power system in this section. William Knight is interested in the company.

NEW ENGLAND, N. D.—Plans are being prepared for a municipal electric plant.

KANSAS CITY, KAN.—The Fairfax Drainage District, Federal Reserve Life Insurance Building, plans to build a substation and transformer house for service in connection with its new drainage works. Electric power equipment will be installed for pumping service and other operations. Henry Reimer is chairman.

Southern States

ANDREWS, N. C.—Plans are being prepared for the construction of a municipal hydro-electric plant on the Hiawassee River, to cost about $300,000.

LITTLETON, N. C.—E. E. Wollert & Son are planning to rebuild their power house and portion of woodworking plant recently destroyed by fire, causing a loss of about $55,000.

SAVANNAH, GA.—The Savannah Electric & Power Company has concluded negotiations for the purchase of the Savannah Lighting Company. Extensions are contemplated to the system.

WASHINGTON, GA.—Davis & Kvaternick contemplate the construction of a power house in connection with a new stave mill, to cost about $45,000.

DELAND, FLA.—Bids will be received by the Board of Trustees of the City of Deland until July 17 for waterworks improvements, sanitary and storm-sewer improvements, etc., including three pumps, two pump houses, one generating unit and accessories. J. B. McCraray Engineering Corporation, Atlanta, Ga., is engineer.

NEW SYMRNA, FLA.—The purchase of an additional unit for the municipal electric light plant is under consideration.

OCOEE, FLA.—The town officials are reported to be considering the purchase of the local electric light and power plant owned by Maguire & Hawthorne. Dr. N. M. Jemsen is chairman of committee.

TALLAHASSEE, FLA.—The Brevard County Power Company, Munsey Building, Baltimore, Md., recently formed with capital of $200,000, plans to install a power plant and system for service in Brevard County, Fla. Herman A. Lang is interested in the company.

LAWRENCEBURG, TENN.—Surveys are being made and plans prepared for a hydro-electric plant on Shoals Creek for the municipal electric light system. The Freeland Roberts Company, Independent Life Building, Nashville, is engineer.

NASHVILLE, TENN.—Bids will be received by J. H. Kirkland, chancellor of Vanderbilt University, until July 16 for construction of hospital and laboratory, nurses' home, power plant and laundry, to cost about $2,000,000. Coolidge & Shattuck, Ames Building, Boston, are architects.

ROGERSVILLE, TENN.—The Kitzmiller-Kenner Company has leased the system of the Rogersville Electric Company. It is planned to enlarge the plant and install a new steam-operated generating unit.

BOAZ, ALA.—The proposal to sell the municipal electric light plant to the Alabama Power Company will be submitted to the voters.

EVERGREEN, ALA.—Arrangements are being made for the construction of a new municipal electric lighting and pumping plant driven by oil engines to replace the present steam-operated plant. Two units of 100 hp. and 50 hp. respectively, it is stated, will be installed.

FLOMATON, ALA.—One of the several substations to be erected by the Alabama Power Company, Birmingham, on the transmission line between Montgomery and Mobile, it is stated, will be located in Flomaton.

GEORGIANA, ALA.—Tentative plans are under consideration for the installation of a municipal electric plant, to cost about $40,000.

GREENWOOD, MISS.—Plans are under consideration for the installation of a new street-lighting system, consisting of about 28,000 linear feet, with single lamp posts.

CAMDEN, ARK.—The Arkansas Light & Power Company plans extensions and improvements to its local system, to cost about $100,000.

CAMDEN, ARK.—T. D. Fooks is planning to construct a power house in connection with a new lumber mill on the Ouachita River, to cost about $50,000.

EL DORADO, ARK.—The Arkansas Light & Power Company plans to build an ice plant here to cost about $80,000.

LITTLE ROCK, ARK.—Extensions to the local light and power plant, to cost about $75,000, are under consideration by the Arkansas Central Power Company.

PARAGOULD, ARK.—Tentative plans are under consideration by the Council for extensions to the waterworks, including the installation of an electrically operated centrifugal pump, control devices, etc.

MONROE, LA.—The Louisiana Glass Manufacturing Company plans to construct a power plant in connection with its proposed local works, to cost about $250,000.

ROSELAND, LA.—The Roseland Veneer & Package Company plans extensions in its power house, including the installation of additional equipment.

HUDSON, OKLA.—The Empire Electric Company plans to build a transmission line to Hudson, via Welch, a distance of about 15 miles.

DENTON, TEX.—An appropriation of $110,000 has been arranged for an addition to the power house at the State College of Industrial Arts, including the installation of new equipment.

HARLINGEN, TEX.—Work will soon begin on the construction of a large central power plant by the Valley Electric & Ice Company, San Antonio, for the purpose of supplying electricity for all towns and industrial plants on the Texas and Mexico sides of the lower Rio Grande Valley. The proposed plant, it is understood, will be located in Harlingen. The equipment will include two Diesel oil engines of 1,125 hp. each. Material has been ordered for the erection of a 33,000-volt transmission line to extend from San Benito to Mission.

HOUSTON, TEX.—Electric power equipment will be installed in the new cotton-compress plant now being constructed by the Houston Cotton Compress Company on the ship channel, to cost about $1,000,000.

ROCK SPRINGS, TEX.—The local electric plant has been purchased by W. E. Eaton, El Dorado, Ark. Improvements are contemplated to the system.

TEMPLE, TEX.—Plans are under consideration for extensions to the ornamental lighting system in the city park, public square and other sections in the downtown district.

Pacific and Mountain States

McCLEARY, WASH.—The McCleary Timber Company contemplates the construction of a power house in connection with the rebuilding of its local veneer plant recently destroyed by fire.

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 18 for one electric traveling bridge crane for the Puget Sound Navy Yard. (Specification 4861.)

VANCOUVER, WASH.—The Northwestern Electric Company will build an addition to its substation at King and Eighth Streets, to cost about $80,000.

HILLSBORO, ORE.—The North Coast Power Company is erecting transmission lines to supply electricity to the towns east of Hillsboro, Reedville and Huber.

ROSEBURG, ORE.—The California Oregon Power Company has applied to the State Railroad Commission for permission to purchase the plants and properties of the Douglas County Light & Power Company, which supplies electricity and water in Douglas County, Ore., and Siskiyou County, Cal. The local system will be connected with the high-tension line of the California Oregon company at Dixonville, 6 miles from Roseburg.

BAKERSFIELD, CAL.—The city planning commission has recommended the formation of a lighting district, comprising sixty blocks, to be improved with an ornamental lighting system. W. D. Clarke is city engineer.

CORNING, CAL.—Application has been made to the State Water Commission by W. H. Samson, Corning, and associates for permission to construct a hydro-electric plant on Clear Creek, Shasta County. The plans call for an initial development of 87,000 hp., to cost about $5,000,000.

FRESNO, CAL.—Plans have been prepared for the installation of an ornamental lighting system on portions of Kerchoff Avenue, Huntington Boulevard, and other streets, consisting of 155 single-lamp standards maintained by underground wires to cost about $25,000. W. Stranahan is city engineer.

LOS ANGELES, CAL.—The Pacific Sash & Door Company will build a power house at its plant on San Fernando Road. Noice & Merrill, Washington Building, are engineers.

ST. HELENA, CAL.—The power plant at the St. Helena Sanitarium was recently destroyed by fire.

SAN BERNARINDO, CAL.—The installation of an ornamental lighting system on Mount Vernon Avenue between Third and Mill Streets, is under consideration.

SAN DIEGO, CAL.—Plans are under consideration for the removal of all overhead wires in the business section. F. A. Rhodes is city manager.

SISSON, CAL.—The Chamber of Commerce is preparing plans for the installation of an ornamental lighting system in a portion of the business section.

TORRANCE, CAL.—Electric power equipment will be installed by the Western Sheet Glass Company, in connection with extensions and improvements in its local plant, to cost about $800,000.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the Federal Power Commission, Washington, D. C., for permission to construct a hydro-electric plant on the Green River, near the Utah-Wyoming State boundary, with initial capacity of about 50,000 hp. A steel-tower transmission line will be erected to connect with the present system. The cost is estimated at about $7,500,000.

WHITEROCKS, UTAH.—The installation of an electric lighting system in Whiterocks is under consideration. William Donner, superintendent of the Fort Hall Indian agency, will be in charge of the work.

Canada

WOODSTOCK, N. B.—The Town Council has applied for authority to issue $35,000 in bonds, the proceeds to be used to install an oil-engine-driven power plant of 250 hp. to supply electricity to operate the waterworks pumping station and for lighting the streets.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Electric Railway Company contemplates the erection of a passenger and freight terminal at Welland Avenue, Balfour and General Streets, to cost from $250,000 to $300,000.

TORONTO, ONT.—Tenders will be received by the chairman of Board of Control, City Hall, until July 24 for furnishing and installing two 2,800,000-imperial gallon centrifugal sewage pumps and motors (Tender No. 24).

MONTREAL, QUE.—The Canadian Paper Board Company, Seignieur Street, is preparing preliminary plans for developing 800 hp., partly by water turbines and partly by steam-driven turbines, on the Lachine Canal, to cost about $200,000. Kerry & Chace, Confederation Life Building, Toronto, are engineers.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 12, 1923)

1,458,902. CONTROLLER FOR REVERSING MACHINES; E. L. Dunn, Worcester, Mass. App. filed July 20, 1918. Apparatus for automatic control.

1,458,907. AUTOMATIC TELEPHONE SYSTEM; G. E. Mueller, Aurora, Ill. App. filed June 25, 1908.

(Issued June 19, 1923)

1,458,935. CONTROL SYSTEM AND APPARATUS; A. J. Hall, Winchcombe, England. App. filed July 30, 1920. For electric railways.

1,458,940. WEATHERPROOF ELECTRIC HEATER; L. P. Hynes, Albany, N. Y. App. filed Oct. 18, 1921. For thawing railway points, switches, etc.

1,458,947. MEASURING INSTRUMENT; P. MacGagan, Pittsburgh, Pa. App. filed Sept. 16, 1918. Method of centering core in direct-current instruments of permanent-magnet moving-coil type.

1,458,949. CARRIER RADIO TELEPHONE SYSTEM; H. W. Nichols, Maplewood, N. J. App. filed Jan. 7, 1922. Pure modulated wave and energy of fundamental carrier frequency transmitted.

1,458,957. COURSE DRAFTER FOR MARINE AND AERONAUTIC VESSELS; R. H. Schachenmeier, Karlsruhe, Germany. App. filed Aug. 20, 1919.

1,458,988. MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS; L. F. Morehouse, Montclair, N. J. App. filed Oct. 29, 1918. Relates to telephone systems.

1,458,999. ELECTRIC LIGHT DEVICE; C. L. Snyder, Marion, Ind. App. filed Jan. 21, 1922. Pull-chain lamp socket.

1,459,003 to 1,459,005. MEANS FOR EQUALIZING TRANSMISSION OVER LINES OF DIFFERENT ELECTRICAL CHARACTERISTICS; G. K. Thompson, Maplewood, N. J. App. filed Oct. 29, 1918. Relates to telephone systems.

1,459,013. COIL-WINDING MACHINE; E. F. Creager and S. Rogers, Anderson, Ind. App. filed Nov. 25, 1918. For winding reactances.

1,459,025. ENGINE STARTER; W. H. Huchins, Rochester, N. Y. App. filed Nov 2, 1916. Arrangement of gears between motor and flywheel.

1,459,047. GROUNDING BOX FOR ELECTRICAL PILOTING CABLES; A. Crossley, Washington, D. C. App. filed Feb. 5, 1921. Connection between box and armor by wedge construction.

1,459,049. ELECTRIC HEATER; A. de Khotinsky, Chicago, Ill. App. filed Aug. 15, 1921. Thermo regulator provided to produce desired temperature.

1,459,070. RHEOSTAT; A. P. Morgan, Montclair, N. J. App. filed June 28, 1921. For varying filament current of electric tubes.

1,459,083. ELECTRIC LAMP; A. W. Becker, Windsor, Conn. App. filed April 20, 1922. Hand flashlight.

1,459,121. STOPPER FOR CLOSING THE CONTAINERS OF ELECTRIC ACCUMULATORS; F. Van de Wiel, Paris, France. App. filed Oct. 25, 1920. Permits escape of gas.

1,459,147. MAGNETIC SEPARATOR; A. Dings, Milwaukee, Wis. App. filed Aug. 5, 1918. Drum type.

1,459,165. ELECTRIC DRIVE FOR VEHICLES; J. Schurch, Los Angeles, Cal. App. filed Jan. 4, 1921. Engine-generator-motor drive.

1,459,174. OVERHEAD ELECTRICAL CONDUCTOR SYSTEM; H. B. P. Wrenn and A. S. O'Donoghue, Cleveland, Ohio. App. filed Nov. 11, 1922. Catenary construction for heavy-duty railways.

1,459,175. TELEPHONE-EXCHANGE SYSTEM; F. Aldensorff, Berlin-Wilmersdorf, Germany. App. filed Dec. 31, 1914. Connections established through electromechanically controlled switches.

1,459,186. TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed April 30, 1920. Machine switching apparatus.

1,459,187. PROCESS OF REDUCING METALLIC OXIDES; E. B. Pratt, East Cleveland, Ohio. App. filed Nov. 2, 1920. Reduction of "flue-dust" ores in electric furnace.

1,459,202. METHOD OF SENSITIZING THE TELEGRAPHONE; L. F. Fuller, Palo Alto, Cal. App. filed Aug. 26, 1918. For high-speed radio-signal recording, etc.

1,459,213. ELECTRIC MEASURING APPLIANCE; G. Keinath, Berlin-Charlottenburg, Germany. App. filed Nov. 2, 1920. Transformers for measuring currents up to 40,000 amp.

1,459,229. MEASURED SERVICE AUTOMATIC TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed May 15, 1919.

1,459,249. LAMP STAND; E. G. Perkins, Youngstown, Ohio. App. filed July 12, 1921. Adjustable stand for supporting lamp.

1,459,274. ELECTRIC POCKET LAMP WITH SIGNAL PANE AND COMPASS; F. Yokoyama, Tokyo, Japan. App. filed Dec. 19, 1919.

1,459,283. ELECTRIC EMERGENCY LIGHTING INSTALLATION; P. Das, Delft, Netherlands. App. filed Aug. 2, 1921. Control arrangement.

1,459,307. ELECTRIC HEATING UNIT; C. A. Laise, Weehawken, and A. J. Gallagher, West Orange, N. J. App. filed April 8, 1922. For immersing liquids and solutions.

1,459,308. SIGNALING APPARATUS; D. G. McCaa, Lancaster, Pa. App. filed April 6, 1920. High-frequency wave system for telegraphy and telephony.

1,459,336. TESTING DEVICE FOR FLASHLIGHT BATTERIES AND LAMPS; W. Link, Ajo, Ariz. App. filed Oct. 21, 1921. Contact test board.

1,459,358. ENGINE STARTER; A. E. Buchenberg, Toledo, Ohio. App. filed April 14, 1919. Electromagnetic means for shifting driving wheel into operative relation with flywheel.

1,459,397. SELF-INDUCTION COIL; R. R. Herrmann, New York, N. Y. App. filed May 2, 1919. Employed to vary frequency of oscillation generator.

1,459,400. ELECTRON-EMITTING CATHODE AND PROCESS OF MAKING THE SAME; C. D. Hocker, East Orange, N. J. App. filed Nov. 17, 1916.

1,459,403. SIGNALLING SYSTEM; C. W. Keckler, Newark, and W. B. Strickler, East Orange, N. J. App. filed Sept. 22, 1919. Remote control of switch in power station.

1,459,412. THERMIONIC TRANSLATING DEVICE; A. McL. Nicolson, New York, N. Y. App. filed April 16, 1915. Construction of electron tube of large output.

1,459,417. ELECTRON DISCHARGE DEVICE; P. Schwerin, New York, N. Y. App. filed Nov. 1, 1916. Able to dissipate a large quantity of heat.

1,459,419. MULTISTAGE AMPLIFIER CIRCUITS; E. O. Scriven, New York, N. Y. App. filed April 30, 1919. Vacuum-tube radio circuit.

1,459,422. ELECTRICAL SYSTEM; H. M. Stoller, New York, N. Y. App filed Sept. 4, 1919. Provision of power to radio set in which thermionic devices are employed.

1,459,425. ARMATURE BACKSTOP; C. H. Wheeler, Midland Park Borough, N. J. App. filed Jan. 4, 1921. For relay armatures.

1,459,427 and 1,459,428. THERMIONIC REGULATOR; P. I. Wold, East Orange, N. J. App. filed July 29, 1918. For controlling voltage or current from generator.

1,459,431. CONTROLLING SYSTEM; L. M. Allen, New York, N. Y. App. filed Nov. 25, 1919. Registers at distant point controlled by operator's key.

1,459,434. TRANSMISSION SYSTEM; D. G. Blattner, New York, N. Y. App. filed June 24, 1919. Receivers for underwater signaling.

1,459,451. ELECTRIC IRON; J. M. Seche, Philadelphia, Pa. App. filed Feb. 6, 1923. Automatic cut-out to prevent overheating when not in use.

1,459,562. LAMP LOCK; R. E. Stouffer, Chicago, Ill. App. filed April 2, 1921. For lights on taximeters.

1,459,563. ELECTRIC LIGHT AND POWER PLANT; P. Thamm, New York, N. Y. App. filed April 21, 1920. Gas-engine drive for farm-lighting units.

1,459,651. HEADLIGHT PLUG; O. L. Carr, Baton Rouge, La. App. filed Oct. 24, 1921. For automobile lights.

1,459,659. ELECTROLYTE FOR STORAGE BATTERIES; H. Ellis, P. S. Hart and W. G. Nunnelly, New Florence, Mo. App. filed Nov. 28, 1922. Composed of 33⅓ per cent of electrolyte and 66⅔ per cent of oil.

1,459,663. TROLLEY-WHEEL GUARD; J. Trunko, Arden, W. Va. App. filed March 12, 1923. Guard prevents accidental dislodgment of wheel.

1,459,665. ELECTRIC IMERSION LIQUID HEATER; S. Abel, Berlin, Germany. App. filed Jan. 21, 1922. For any voltage between 110 and 220.

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Printed in the First Issue of Each Volume

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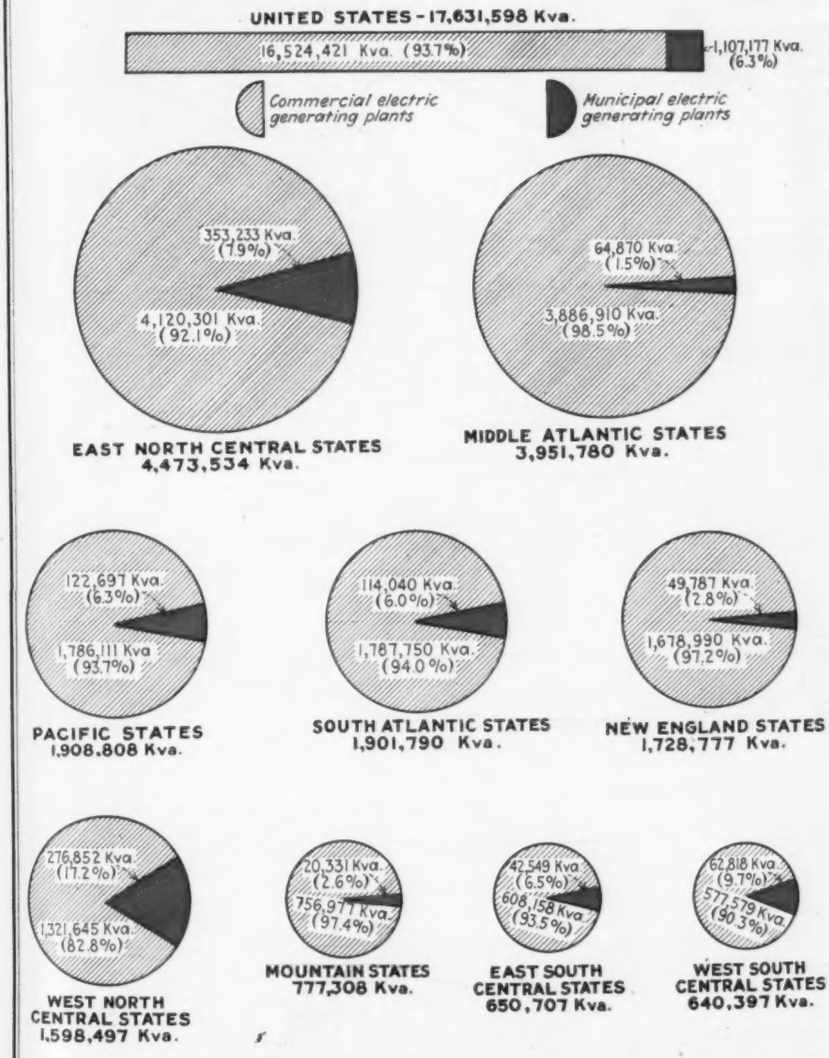
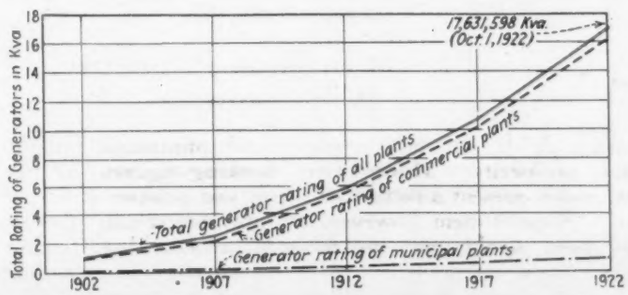
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Only 6.3 per Cent of the Total Generator Rating of the Central Stations Is Installed in Municipal Plants



Commercial Central Electric Generating Plants Have Experienced an Ever-Accelerated Growth



Dwindling Importance of the Municipal Systems

"To win public opinion is to win the race"

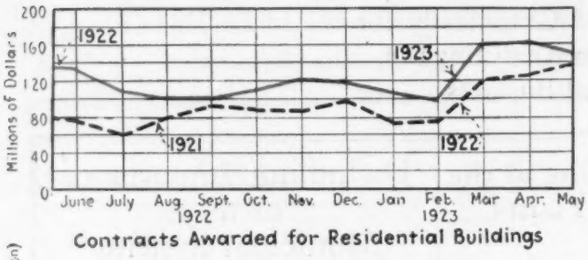
As a basic factor in the national economic life of the electric light and power industry the municipally operated generating plant is becoming of less and less importance as time passes. It is true that since the birth of the industry a large percentage of the operating systems of the country have been controlled by municipalities, but the activities of the unit systems thus operated have been almost without exception entirely local. Such being the case, the installed generator rating and the output of the municipal plants have been, and are at present, low in comparison with the generating equipment and energy output of the commercial systems which know no city, county or state boundary in their activities.

Back in 1902 only 9.6 per cent of the total generator equipment of the central stations of the country was operated by municipalities. This percentage has gradually decreased year by year until at the present time the municipal plants can account for only 6.3 per cent of the total central-station generator rating and only about 3 per cent of the output. Only in the West North Central States does the municipal system really become a near-controlling factor. In this section 43.7 per cent of the generating and distributing systems are owned by municipalities, but even in this territory only about 15 per cent of the total generator rating is municipally operated.

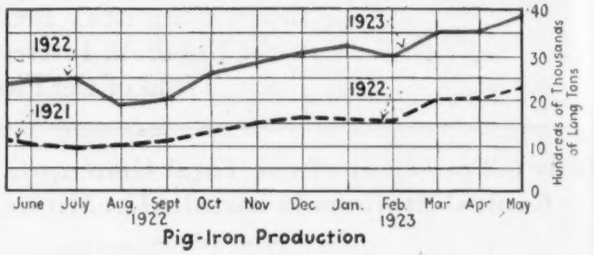
Freedom from politics and inefficiency due to "pull" rather than merit, interconnection which guarantees a supply of electrical power without interruption, low cost to the consumer as a result of bulk production of energy, and the gradual growth in the mind of the average citizen of distrust for publicly operated utilities, all taken in connection with the excellent public relations which have been cultivated by the commercial companies for the past forty years, are the fundamental reasons for the commanding place which the privately owned system has attained in the electric light and power industry. It is only another instance of the "survival of the fittest" as applied to commercial life.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

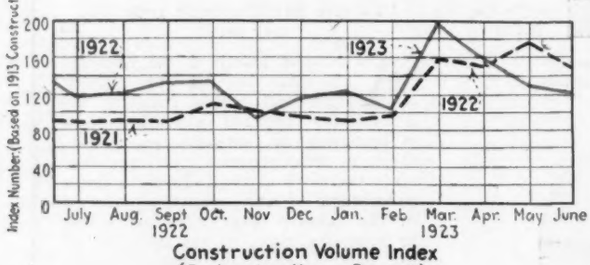
How the Primary Industries Are Trending



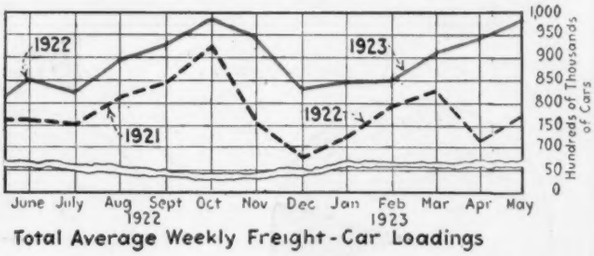
Contracts Awarded for Residential Buildings



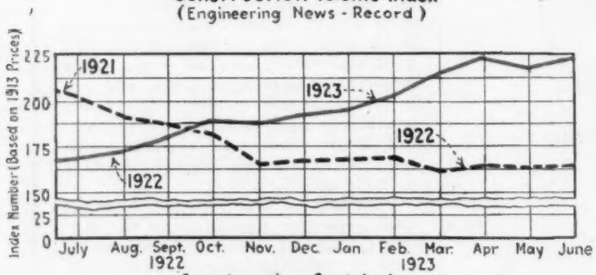
Pig-Iron Production



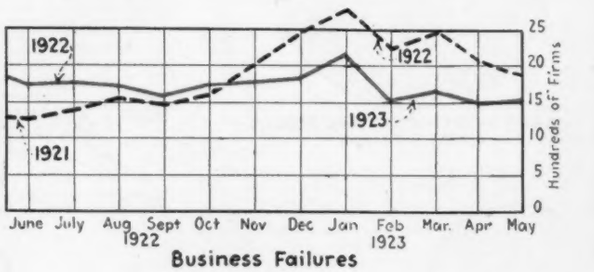
Construction Volume Index
(Engineering News-Record)



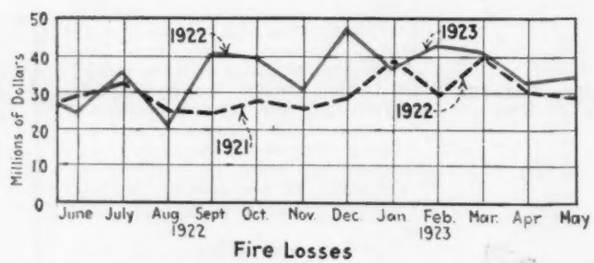
Total Average Weekly Freight-Car Loadings



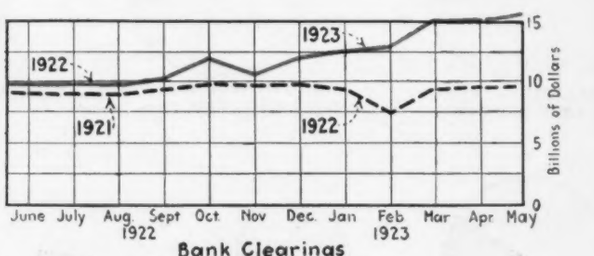
Construction Cost Index
(Engineering News-Record)



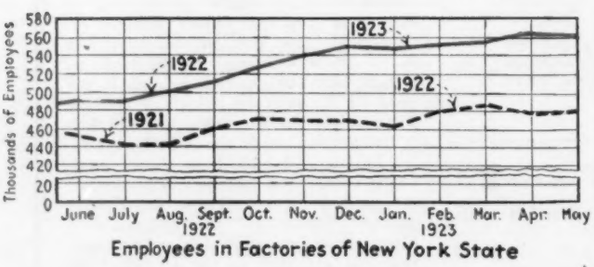
Business Failures



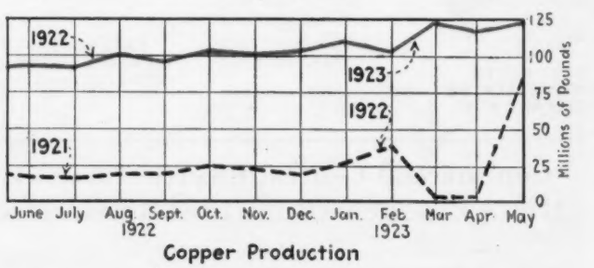
Fire Losses



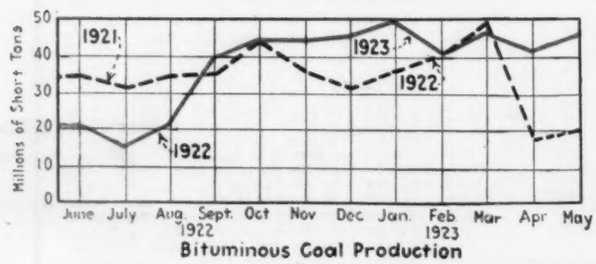
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Present Business Prosperity Will Continue

ALL prominent economic bureaus predict continued business prosperity. Money rates, banking figures and security issues present a picture of active and prosperous business. None of them, however, indicates that strain has thereby been placed upon the financial structure of the country, and so long as this remains true a continuance of present business prosperity may be expected.